



# MAINTENANCE GUIDE

## AML/E

AUTOMATED

MIXED-MEDIA

LIBRARY

/ENTRY

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Order No. DOC C0 022

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# 1 Data of Your AML/E System

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## 1.1 Technical Data

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### 1.1.1 Electrical Data

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	Europe	North-America
Power AMU	230 V $\pm$ 10 % 1, N, PE	115 $\pm$ 10 % 1, N, PE
Power entire system	230 V $\pm$ 10 % 1, N, PE	208 V $\pm$ 10 % 2, N, PE
Fusing (customer's site installation)	Brake 16 A MT (type C)	Brake 15 A MT (type C)
Voltage, power section	310 V DC	
Frequency	50 Hz	60 Hz
Control voltage	= 24 V	
Enclosure type	IP 50	

## 1.2 Components

---

The main components are:

- AML/E management unit (AMU) and operating panel
- handling unit
- archive
- input and output area (I/O unit)

## 1.3 Emission

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- Noise 80 dB(A)

## **1.4      Layout of Your AML/E-System**

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### **1.5      Examples of System Layouts**

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Symbol explanation:

AMU	AML management unit and operating cabinet
IO	I/O unit
HU	Handling unit
HT	Hexa tower
DC	Drive controller
D	Drive for cassette tapes
OD	Drive for optical disks
QT	Quadro tower
CC	control cabinets with control and supply components and operating panel
MR	Maintenance room

Examples of System Layouts

1.5.1 System with 4 Hexa Towers

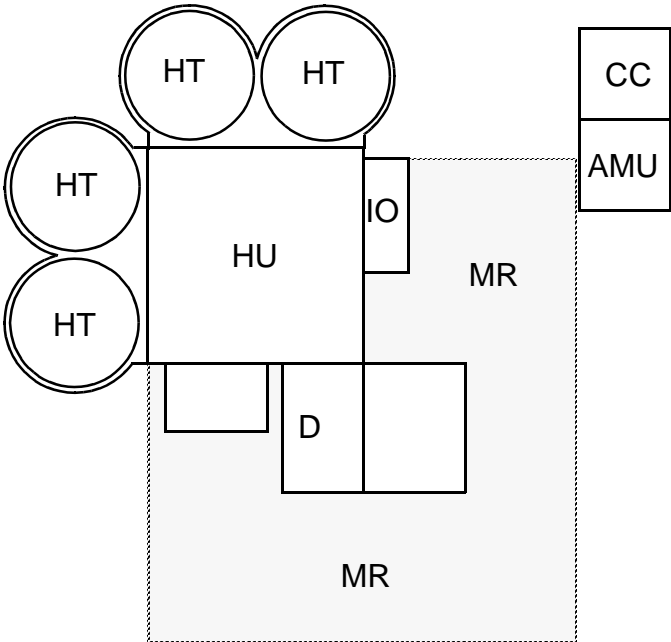


Fig. 1-1: Layout Example with 4 Hexa Towers

1.5.2 System with 1 Quadro Tower and 2 Hexa Towers

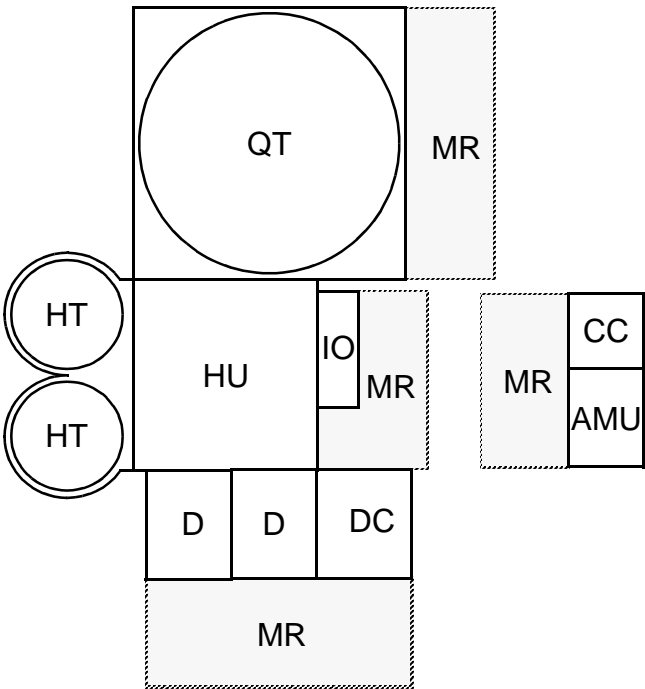


Fig. 1-2: Layout Example with 1 Quadro Tower and 2 Hexa Towers

1.5.3 System with 2 Quadro Towers

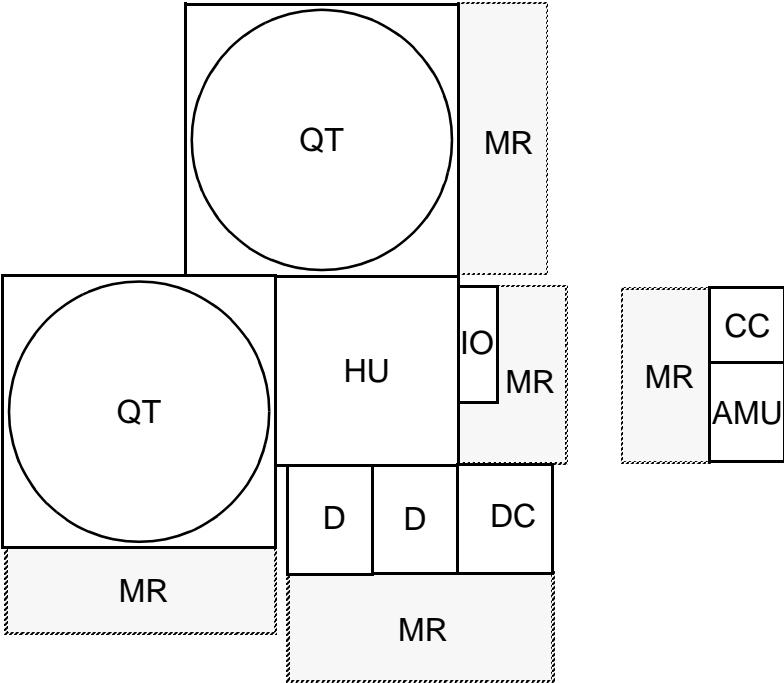


Fig. 1-3: Layout Example with 2 Quadro Towers



## 2 Before You Begin Working with AML/E

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### 2.1 Explanation of Symbols and Notes

---

The following symbols and highlighted passages draw attention to important information.



Explanation of these symbols (☞ "Hazard Alert Messages" from page 3 - 2)



#### Information/Advice

#### Information important for understanding this introduction.

<KEY> Operating element/key on the operating panel or the keyboard of the AMU processor

1 key on the PHG (handheld programming unit)

<1> + <2> Press these buttons at the same time

"ABCD" Heading, e.g. chapter 3 "For your safety"  
technical term, e.g. "Manage users"  
file name, e.g. "AMUICONF.INI"

**ABCD** term appearing on the AMU or PMMaint interface

ABCD command line appearing in the OS/2 input window,  
e.g. [C:\]cd amu

☞ reference to a description  
- somewhere else in this manual (IG - Installation Guide)  
(☞ page 2/3)  
- in another manual:  
AIG (AMU Installation Guide),  
ARG (AMU Reference Guide),  
OG (Operator Guide),  
MG (Maintenance Guide)  
(☞ MG 4.5.5 "Board CP/MEM")

## 2.2 Assistance

---



If you cannot solve a problem with the aid of this document or if you are interested in a recommendation regarding training, please contact your contract Partner or the ADIC/GRAU Technical Assistance Center (ATAC).

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### 2.3 About This Manual

---

This manual contains all information and instructions you need to maintain the equipment safely.

You have received comprehensive training from ADIC/GRAU Storage Systems and can operate and maintain the AML/E system without endangering yourself or others.



#### **WARNING!**

**Operation and maintenance of the AML/E system by untrained persons can lead to dangerous situations.**

**The consequence could be severe or fatal injury caused by moving parts or contact with live connections.**

**Introductory training at ADIC/GRAU Storage Systems therefore is an indispensable precondition for all who work with the AML/E system!**

As maintenance personnel you also are responsible for ensuring that only qualified personnel authorized by ADIC/GRAU Storage Systems carries out the following on the equipment:

- prepare for operation
- set-up
- start
- operate
- shut down
- maintain
- restart

Refer to the Operator Guide when you encounter an operating problem.

If you cannot solve a problem,

- call a specialist
- ask for information from your service partner or ADIC/GRAU Storage Systems

Please note, however:



#### **WARNING!**

**Some work and adaptations you may carry out only if you have the appropriate qualifications and training!**

**And most importantly:**

**Be sure to read Chapter "For Your Safety" (☞ page 3 - 1), before you begin working with the equipment!**

## **2.4 Copyright**

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This document is copyrighted and may not, without written permission from ADIC/GRAU Storage Systems, be copied either in whole or in part, duplicated, translated or held on any electronic medium or in machine readable form.

The AML/E system (mechanics, hard- and software) described in this document is supplied on the basis of a general license agreement or single license (entailing the commitment not to pass it on to third parties). The software may only be used and copied as authorized by the agreement. The same applies without restriction to the entire documentation of the AML/E system. Who copies the software (AMU, handling unit control) without authority onto cassettes, disks or any other storage medium is liable to prosecution.

ADIC/GRAU Storage Systems reserves the right to change or adapt the functions described in this manual without stating reasons.

AML/E	registered trademark of ADIC/GRAU Storage Systems - Germany
BOSCH	registered trademark of Robert Bosch GmbH
IBM	registered trademark of IBM
OS/2	registered trademark of IBM

## 2.5 Product Observation

We are obliged by law to monitor our products even **after** delivery to the customer.

Therefore please communicate every point of interest.

- modified set-up data
- experiences with the product
- repetitive faults
- difficulties with this manual

[illegible]

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## 3 For Your Safety

---



### Information

**In addition to the safety instructions in this manual, local and professional safety rules apply.**

Avoid hazards when operating the equipment

- by safety-conscious behavior
- by careful action

Read and carefully observe the hazard alert information in this manual and in the Operator Guide.



### ATTENTION!

**Knowing and observing the instruction are indispensable for safe operation of the AML/E system.**

### 3.1 Intended Use

---

The offer and the order confirmation as well as the purposes for use defined in these documents are part of the AML/E documentation. Any use other than the specified, is not considered intended use.

This equipment is designed for processing of

- magnetic tape cassettes
- optical disks
- VHS-cassettes

Any other application is not considered intended use.




ADIC/GRAU Storage Systems shall not be held liable for damage arising from unauthorized use of the system. The user assumes all risks in this aspect.

Intended use also includes

- observing the instructions supplied with the equipment (Operator and Maintenance Guides)
- observing inspection and maintenance instructions

## 3.2 Hazard Alert Messages



We classify the hazards in several categories. The following table shows the relation of symbols, signal words, the actual hazard, and its (possible) consequences.




Symbol	Damage to...	Signal Word	Definition	Consequences
	People	<b>DANGER!</b>	imminently hazardous situation	death or serious injury (maiming)
		<b>WARNING!</b>	potentially hazardous situation	possibly death or serious injury
		<b>CAUTION!</b>	less hazardous situation	possibly minor or moderate injury
	Property	<b>ATTENTION!</b>	potentially damaging situation	possibly damaging to: <ul style="list-style-type: none"> <li>the product</li> <li>its environment</li> </ul>
		<b>Information</b>	tips for users and other important/useful information and notes	no hazardous or damaging consequences for people or property



### 3.3 Further Symbols

The table below lists all symbols used in this manual and explains their meaning.

Symbol	Damage to ...	Signal Word	Definition	Consequences
	People	<b>WARNING! Hazardous Voltage!</b>	potentially hazardous situation  replaces the pictorial  hazard of electric shock	possibly death or serious injury  After an EMERGENCY STOP and also after switching off the main switch, voltage can still be present at the places marked with this symbol.  Hazard of fatal electric shock.
	Personen	<b>CAUTION! Laser Light! Do not stare into beam</b>	less hazardous situation: laser light	possibly minor or moderate injury  lase light during opening
	Personen	<b>CAUTION! Danger Light!</b>	less hazardous situation: laser light	possibly minor or moderate injury  use of controls, adjustments, or performance of procedures other than specified may result in hazardous laser light radiation exposure

Symbol	Damage to ...	Signal Word	Definition	Consequences
	People	-	less hazardous situation: wear safety glasses	possibly minor or moderate injury
	People	-	less hazardous situation: wear safety shoes	possibly minor or moderate injury
		-	identifies the address of your contact person	no hazardous or damaging consequences for people or property

## 3.4 Area of Application

This information applies to the entire AML/E system.

Further safety instructions for components used in the equipment are not invalidated by these instructions.



### Information

**Other manufacturers' documentation forms an integral part of the AML/E documentation.**

## 3.5 Intended Audience/Authorized Persons

### 3.5.1 Intended Audience

This Maintenance Guide is intended for **service- and maintenance work**. Consequently, the hazard alert messages apply only to maintenance of the equipment.

Authorized persons for service and maintenance are the trained specialists of the

customer and the maintenance personnel of the service partner.

**3.5.2 Authorized Personnel**

---

Only **trained** specialists (maintenance training) are allowed to maintain and repair the AML/E system. The names of trained specialists are entered into the system logbook.

Knowledge of safety rules for work on electrotechnical systems is therefore expected.

The system logbook can be found in a compartment on the inside of the control cabinet door.



**System Logbook**

Order-No.:			
Customer:			
Address:			
Contact Person:			
Tel.:			
Fax:			
Trained staff of customer (VBG 4 / VDE 0105 / VDI 2853) :			
Name:	Signature:	Name:	Signature:
	_____		_____
	_____		_____
	_____		_____
	_____		_____
Service-Partner:			
Tel.:			
Fax:			
Trained specialists of the service partner (VBG 4 / VDE 0105 / VDI 2853):			
Name:	Signature:	Name:	Signature:
	_____		_____
	_____		_____

Fig. 3-1: System Logbook

## 3.6 Guards

---

The system is equipped with the following guards:

- monitored access to the archive
- <EMERGENCY STOP> on the I/O unit
- monitored guard door on Quadro tower

### 3.6.1 Access to the Archive

---

Inside the archive on new systems an <EMERGENCY STOP> button is located on the inside of the I/O unit.

The archive is completely enclosed in a housing. The only access to it is a monitored guard door. The interlock is active when the main switch has been switched on.

The guard door cannot be opened in operating mode “AUTO”.

The housing around the archive serves as a **separating guard** according to VDI 2853. It separates the danger area of the AML/E system from the normal working area.

The danger area (archive) of the AML/E system is the area in which persons could be injured due to hazardous movements of the handling unit or the storage towers.

Hazardous movements can be:

- expected movements
- unexpected movements

The guard door can be opened from the outside only with a key. The authorized person is responsible for this key.



#### **WARNING!**

**In the archive, movements of components can cause serious injury.**

**Access to this area is therefore restricted to authorized persons. Persons who have not been trained in the use of the system may only enter the archive under supervision.**

**Access to the archive is allowed only**

- System is provided with a plug on the power supply cord (type „B“), disconnect system with the supply plug
- **after switching off the main switch and**
- **securing it against being switched on again**

Unauthorized persons are especially at risk in the danger area since they

- are not trained in operating the system
- are not aware of the hazards
- cannot correctly appraise the reactions of the system

### 3.6.2 <EMERGENCY STOP> Buttons

---



#### Information

**The yellow luminous push-button <CONTROL OFF> on the operating panel has the same function as the <EMERGENCY STOP> button.**

All <EMERGENCY STOP> buttons ( I/O unit, archive, PHG...) have the same function:

EMERGENCY STOP switches off the output electronics. All movements of the handling unit and the storage towers stop immediately.

When persons or property are at risk immediately press the nearest <EMERGENCY STOP> button.

Moving parts stop at once.



#### **WARNING!** **Hazardous Voltage!**

**Pressing an <EMERGENCY STOP> button will not render the entire AML/E system voltageless. Only the drive amplifiers are switched off.**

Emergency stop does not switch off:

- the control units of the handling unit and the storage towers
- the AMU
- the drives
- the compressed air supply

Shut off the power supply to these components at a suitable point (e. g. connecting plug or switch)!

The following components are no part of the main switch circuit:

- AMU processor
- drives
- compressed air



### **ATTENTION!**

**If the <EMERGENCY STOP> buttons are frequently used contrary to their purpose, just to stop the system, this may lead to:**

- increased wear of mechanical parts
- damage to electronic and electric components of the AML/E system

**Do not use the <EMERGENCY STOP> buttons to stop the normal operation of the AML/E system.**

**Stop the system only with the appropriate AMU or host computer commands (⇐ HACC/ROBAR)!**

ADIC/GRAU Storage Systems will not be responsible for damages caused by improper use of the <EMERGENCY STOP> buttons. The risk lies entirely with the user.



### **WARNING!**

**Movement of components inside the archive can cause serious injury.**

**Before releasing the <EMERGENCY STOP> buttons and before starting the AML/E system, ensure that the start will not endanger persons or property!**

### 3.6.3 Operating Modes of the AML/E System

---

#### Operating mode “AUTO”

In the “AUTO” mode the host computer controls the AML/E system.



#### **WARNING!**

**Movements of components in the archive can cause serious injury.**

**In “AUTO” mode nobody must be inside the archive.**

**Before starting “AUTO” operation ensure nobody is in the archive.**

The archive access interlock is active as soon as the main switch has been switched on. All other guards are active as soon as the luminous push-button <CONTROL ON> has been pressed.

#### Operating mode “EMERGENCY”

The operating mode “EMERGENCY” is intended for

- manual input and output of media
- manual operation of drives
- manual movement of drives

In this operating mode, personnel listed in the system logbook (trained persons and trained specialists) are allowed to work inside the archive.



#### **WARNING!**

**The door interlock of the archive access is not active in this operating mode.**

- Lock the main switch in position “OFF”.
- Safely guard the key or keep it with you always.

the handling unit is shut down.

### 3.6.4 Guard Door of Quadro Tower

In the operating mode “AUTO” the guard door of the quadro tower

- must be open (AML/2 system).
- must be closed (AML/E system).

When the Quadro tower moves the guard door is locked.

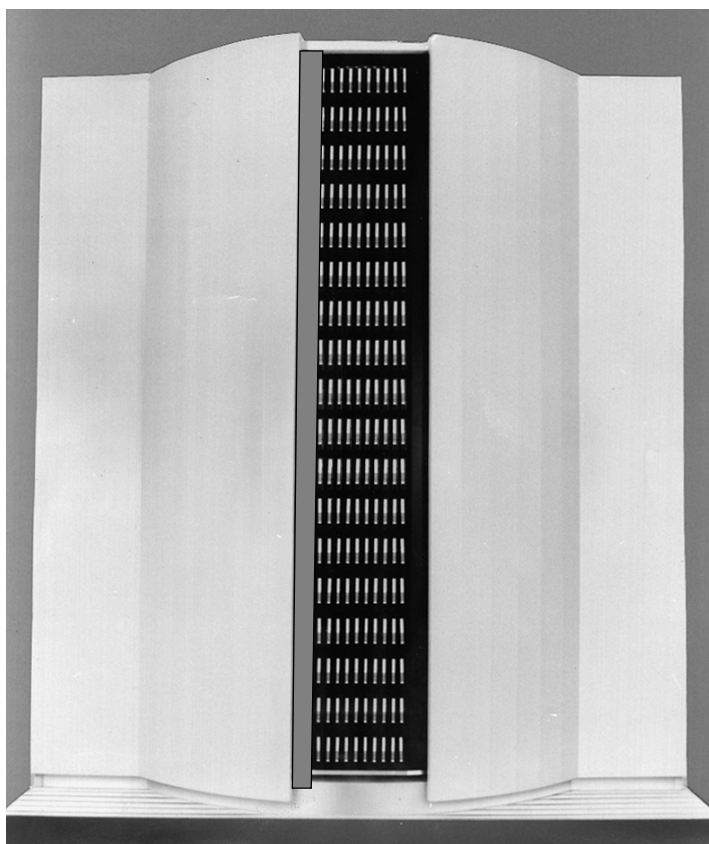
In the AML/E system it can be opened only in operating mode “EMERGENCY”.



#### Information for AML/2 twin systems

**If both robots are to run in the “AUTO” operating mode, the guard doors must be open on both sides.**

**If one robot is to run in the “AUTO” operating mode and the other in the “MANUAL” operating mode, the guard doors must be closed on the “manual” side.**



*Fig. 3-2: Quadro tower Guard Doors*



### 3.7 Before Working on the Equipment

---



#### **DANGER!**

Before commencing work, familiarize yourself with the location of

- the <EMERGENCY STOP> buttons
- the main switch

Never put guards out of operation other than instructed.



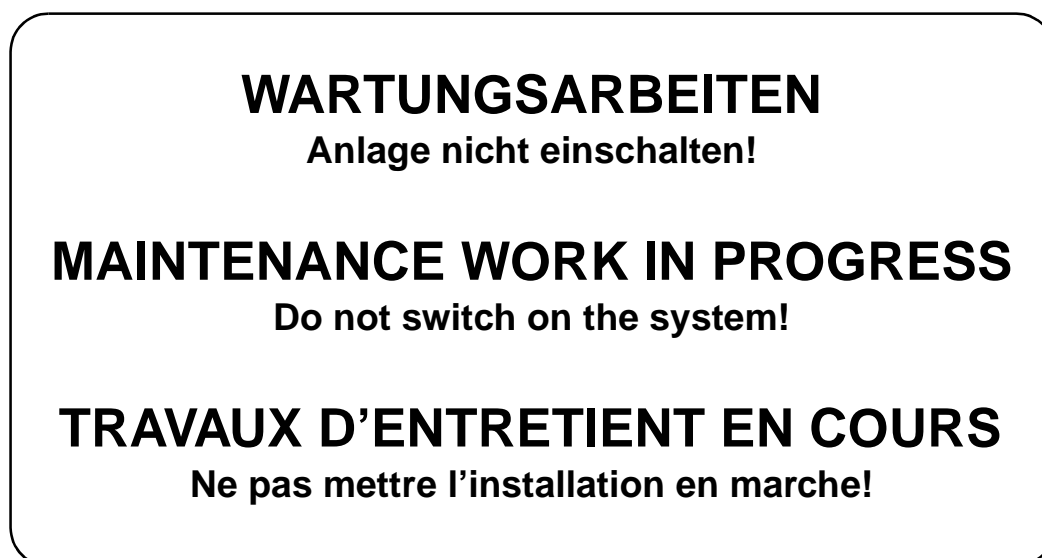
#### **Information**

**Bridging of such guards is forbidden and lead to legal prosecution!**

- Before commencing with maintenance or repair work switch the AML/E system off with the main switch.
- Secure the main switch with a padlock against switch-on.
- Carefully guard the key or keep it with you always.

All drive units and all hazardous voltages are switched off.

Put the yellow sign with following text onto the system:



*Fig. 3-3: Warning Sign*

Proceed with utmost care, if you do not switch the system off with the main switch because of required work (e. g. functional checks).

For such work, apply the described operating modes and measures before starting work (→ beginning of respective chapters).

### 3.8 Before Restarting the Equipment

---



**WARNING!**

Movement of components inside the archive can cause serious injury.

Before starting the AML/E system, ensure that nobody is inside the archive.

### 3.9 Working on Live Parts

---



**DANGER**

Contact with live parts can cause severe or fatal burns and internal injury as the consequences of electric shock. After contact with live parts people often cannot by themselves break loose from the part.

A second person must stand near the main switch to be able to switch it off immediately in a hazardous situation.

Components worked on must be live only when this is specifically required.

The main switch and the push-button <SYSTEM LIGHTING> are live even when the main switch is shut off. When working on these parts disconnect the plug X1B on the bottom left inside the control cabinet (☞ page 10 - 42).

Before working on other electric components switch off power with the main switch and secure the switch with a padlock against power-up.

Carefully guard the key or keep it with you always.

## Working on the drive cabinet

---

Work on live parts of the equipment must be authorized by your superior.

When carrying out such work, be sure to observe the following

- the accident prevention rules (e.g. VBG 4)
- the standard VDE 0105
- the following points:

Use only suitable tools and measuring devices in good working condition.

Check the measuring devices for correct adjustment of measuring ranges.

Work with one hand only. This can prevent injury to internal organs in case of electric shock, because the electric circuit will not be closed (through both arms and the body).

Avoid contact with conducting floors (especially of metal) or equipment parts. If necessary, cover the working area with suitable protective rubber mats.



### **DANGER**

**Never assume a circuit is voltageless - always check it for your safety!**

## 3.10 Working on the drive cabinet

---



### **WARNING!**

**The drive cabinet can turn over if you pull out more than one drive rack. Just pull out one drive rack at a time.**

### 3.11 Mechanic Maintenance Work

Observe the following:

- where are the escape routes and emergency exits - be sure to keep these free of obstacles
- keep dismantled machine components and other parts safely and inaccessible for unauthorized persons
- keep the equipment clean during work, be sure to tidy up carefully afterward

After maintenance be sure to reinstall safety provisions that had been removed for the maintenance job, such as:

- covers
- hazard alert messages
- warning signs
- grounding wires

Your clothing must be in agreement with the safety rules. It must

- not have metal fasteners
- should be so close-fitting that it cannot be caught in moving machine parts

Button up the sleeves or roll them up.

Put the ends of a scarf you wear into the clothing.

For long hair use a protection that fully covers it.

Take off your watch, rings, jewelry etc.



Wear safety glasses when

- using a hammer
- using an electric drill
- working on springs, retaining rings etc.
- soldering, working on cables
- cleaning with chemical agents
- changing oil (hazard of oil splashes)
- all work that endangers the eyes

When handling heavy components wear safety shoes.



#### **ATTENTION!**

**Refrain from any action that could endanger people, or that could damage installations or equipment.**

### 3.12 Safety Check

---

Check all guards every 6 months:

- <EMERGENCY STOP> button on the front of the I/O unit
- door interlocks
  - archive access
  - Quadro tower guard door

### 3.13 High Leakage Current

---



#### **WARNING**

#### **High Leakage Current**

**Earth connection essential before connecting supply.**



## 4 About the AML/E System

---

### 4.1 General

---

The name **AML/E** is an acronym made up of the first letters of

- **A**UTOMATED
- **M**I**XED**-**M**EDIA
- **L**IBRARY
- **/E** means Entry

The host computer is linked to the AML/E system by the AMU (AML Management Unit).

## 4.2 How the Components Work Together

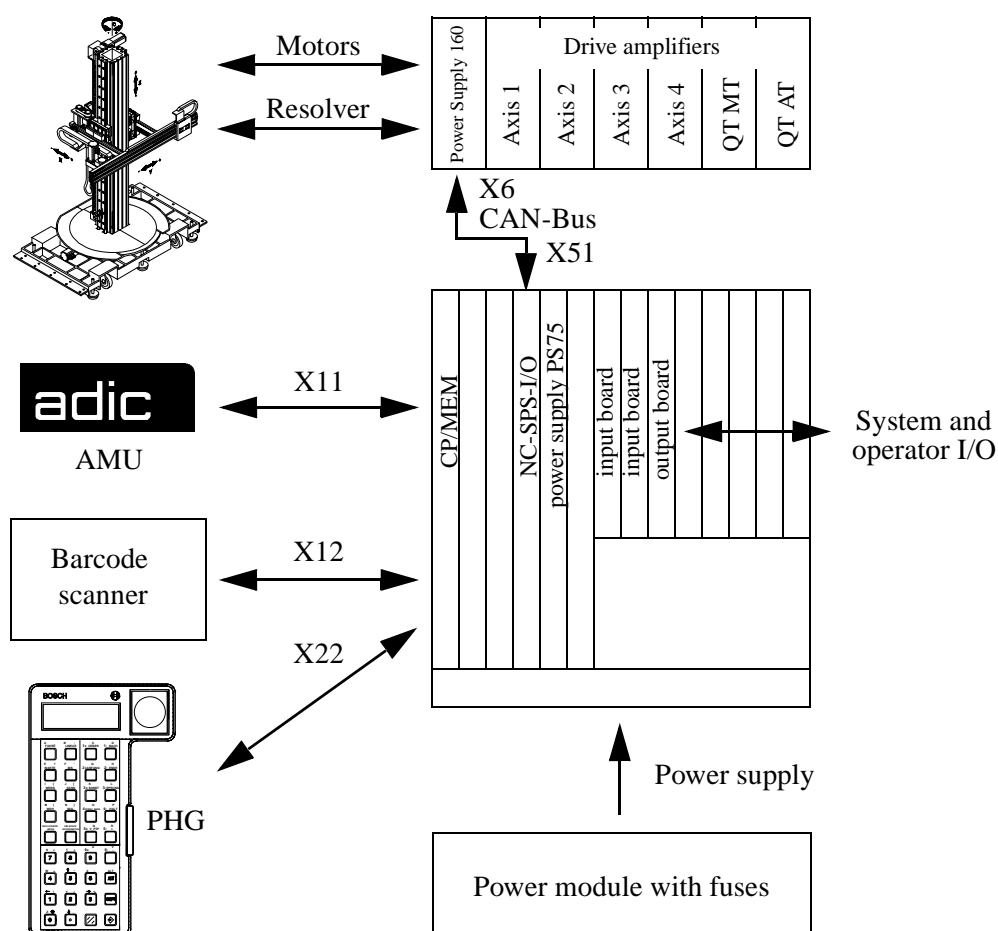


Fig. 4-1: How the components work together



# How the Components Work Together

Flow of command execution:

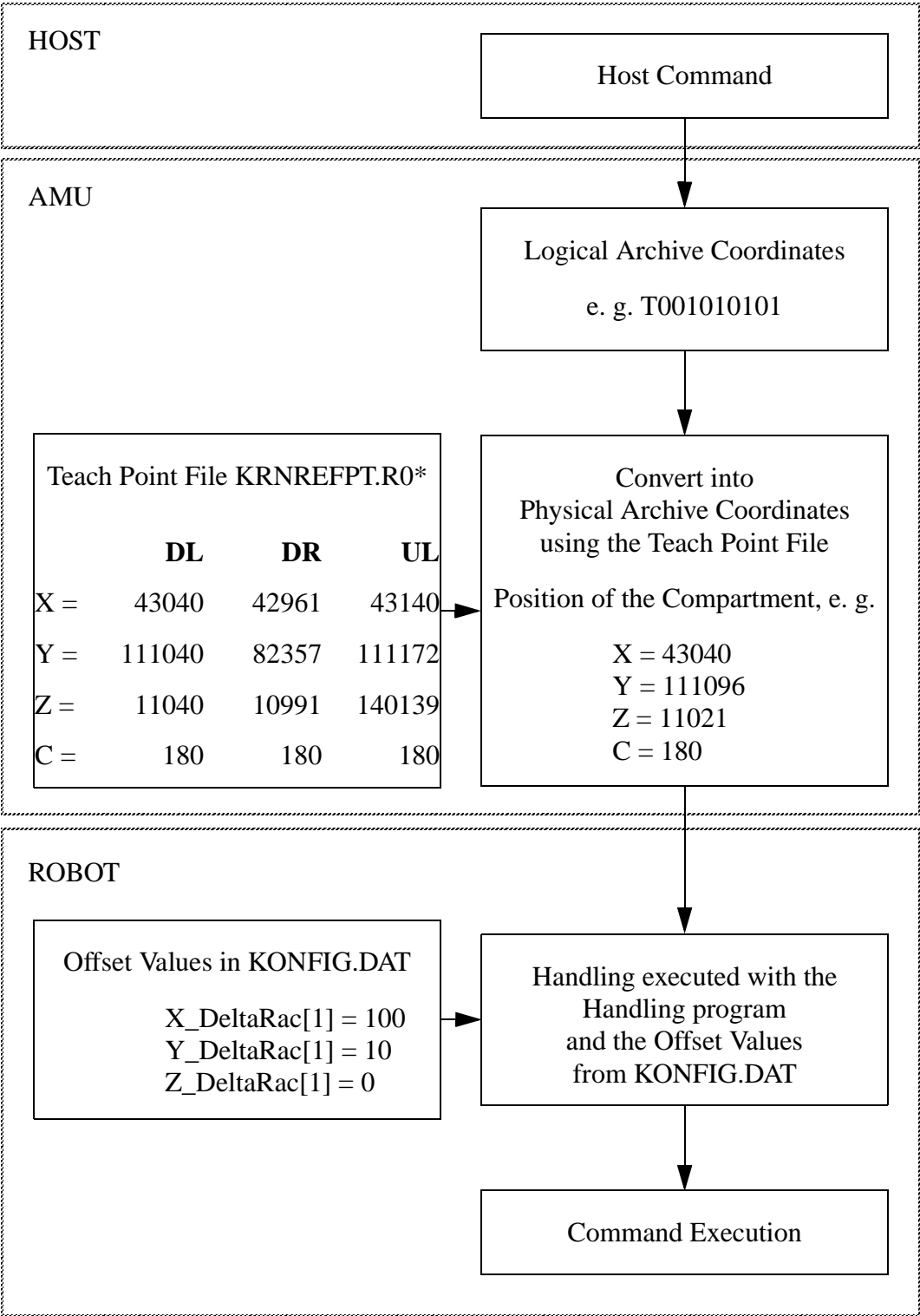


Fig. 4-2: Flow Chart of Host Command Execution

### 4.3 AML/E Management Unit (AMU)

---

The AMU is the central interface of the unmanned AML/E system. In normal operation (“AUTO”) the host processor controls the system.

AMU consists of hardware and software (AMS means AML management software).

#### 4.3.1 Tasks of AMU

---

- Host communication
  - interprets commands received from the host processor
  - checks these commands for executibility
- Management of archive catalog
  - saves the logical coordinates of the compartments
  - assigns media to compartments
  - tracks down the status of compartments and drives
- Converting logical coordinates into physical coordinates
- Communication with
  - the control unit of the handling unit and storage towers
- Operator interface for
  - first operation
  - service
  - the operator
- Communication of errors (LOG and Trace)
- Configuration (describes the individual structure of the archive)



#### Information

**AMU does not register the data content of media.**

**For further details see AMU Reference Guide.**

### **4.3.2 Hardware**

---

PC 486 or higher

- 16MB RAM, min. 200 MB harddisk
- SVGA or XGA graphic adapter, colour monitor
- mouse
- interfaces to
  - host processor
  - handling unit control unit

### **4.3.3 Software**

---

- operating system OS/2
- database manager DB 2/2
- communications manager CM/2 (inclusive LAN Adapter Protocol Support)
- distributed console access facility DCAF
- TCP/IP (optional)

#### 4.3.4 AMU Application

The software consists of five individual programs (processes) running in parallel (Multi-Tasking). Each process accomplishes a specific task.

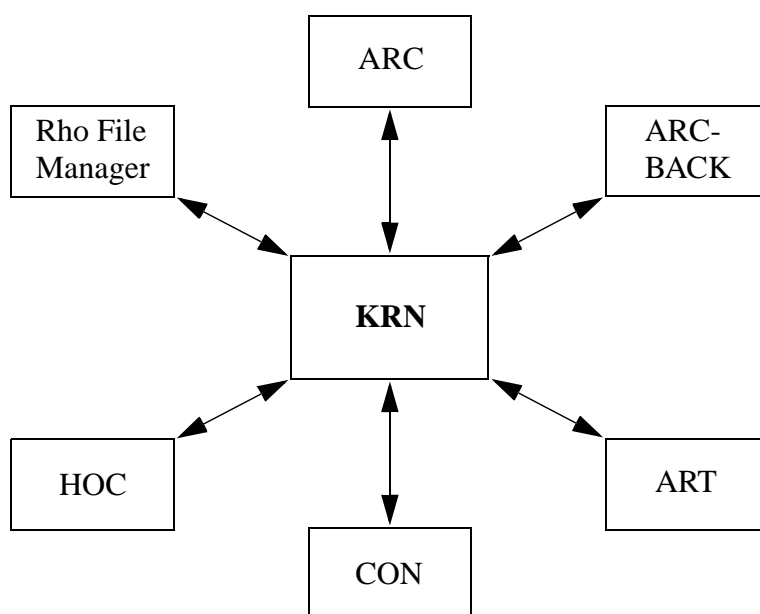


Fig. 4-3: Processes of AMU

- **ARC (ARChive)** management and journaling of the archive catalog; SQL database
- **ARCBACK (ARChive-BACKup)** backup and restoration of the archive catalog (database)
- **ART (AleRTer)** writes logs and traces
- **CON (AML Operator CONsole)** operator console
- **HOC (Host and Other Communication)** Communication with
  - host computers
  - controls of the handling unit and the storage towers
- **KRN (KeRNeL)** central logic, converts host commands into control commands
- **RFM (Rho File Manager)** transfers files (control software) between the AMU and the rho control

### 4.4 Product Description - Mechanic Components

---

#### 4.4.1 Handling Unit

---

##### Description

The handling unit is a cartesian robot with one turning and three linear axes. It is mounted on a cast iron baseplate and is constructed of aluminium profiles and guide rails from the mechanical elements program of Bosch.

It is driven by electric motors (brushless, electrically commutated motors) and planetary gears or drive belts adapted to the axes. The rotation of the motors is converted into linear movements of the robot's axes by toothed drive belts of limited extensibility and low wear. A gear support table ensures stable standing of the axes. Since the axes are provided with a relative measuring system (absolute to one motor revolution) proximity limit switches are located at the end of each axis to define a reference point.

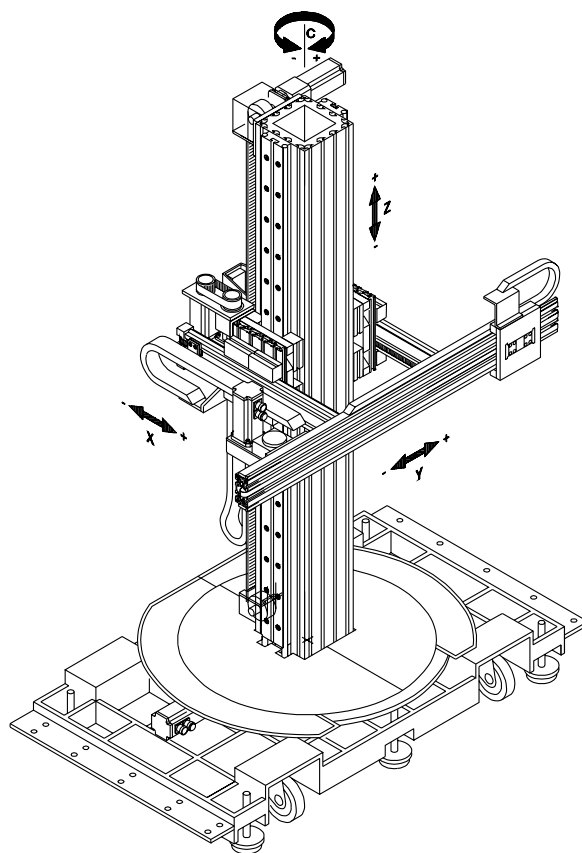


Fig. 4-4: Handling Unit

### Coordinate system of the handling unit

The following figure shows in top view:

- the coordinate system
- the direction of axis movements

During the configuration in the AMU each side is defined with a multiple of  $90^\circ$  (**Arrangement**:  $0^\circ$ ,  $90^\circ$ ,  $180^\circ$  and  $270^\circ$ ).

In the text program each side is assigned a quadrant number (1 =  $0^\circ$ , 2 =  $90^\circ$ , 3 =  $180^\circ$  and 4 =  $270^\circ$ ). The respective side is accessed by input of the quadrant number. The quadrant number 1 =  $0^\circ$  corresponds to the position of the reference point of the turning axis (axis 4).

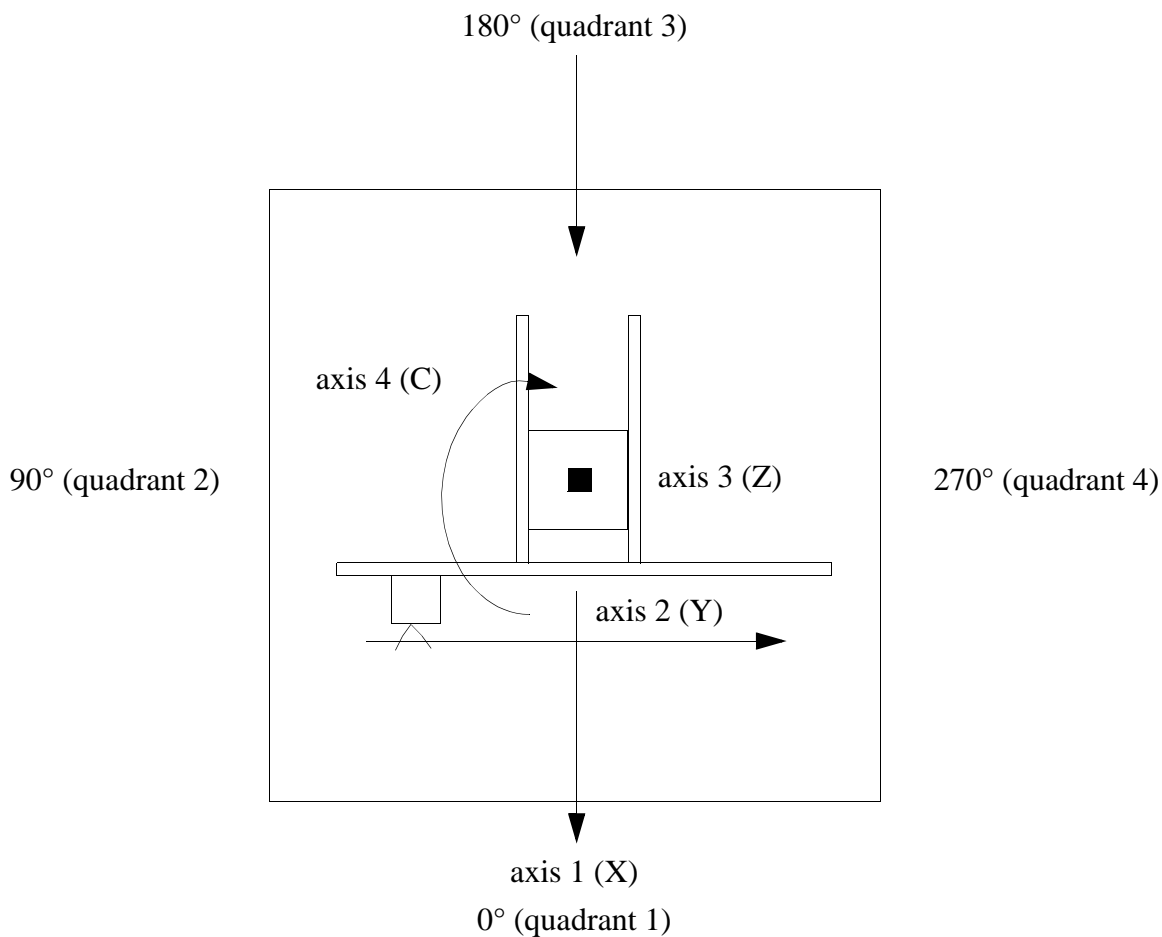


Fig. 4-5: Coordinate System of the Handling Unit

### Gripper

An electromechanical gripper is mounted to the handling unit for safe handling of various media (magnetic tape cartridges, VHS cartridges and optical discs). It is mechanically coupled to the handling unit by a shock absorbing flange.

All gripper movements are powered pneumatically by micro valves and cylinders or by springs.

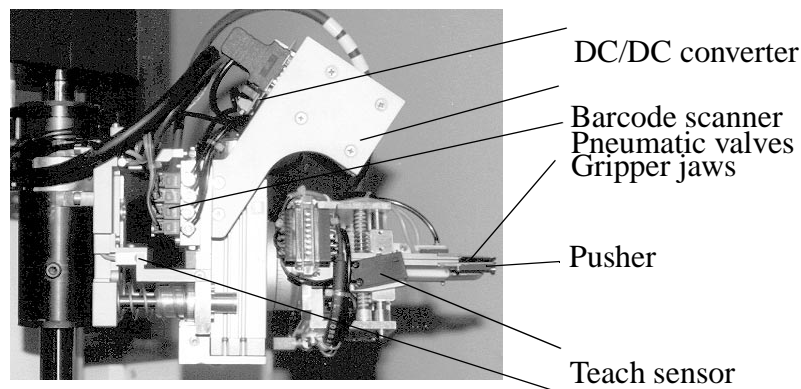
Following gripper movements are possible (all end positions identified by \* are monitored by sensors):

- gripper open
- gripper closed (held closed by springs even when power fails)
- gripper vertical (put down media in the archive)
- gripper horizontal (mount media in drives)
- gripper tilt 7° (operation of special drive types)
- gripper 0° (operation of the archive)
- pusher forward \* (reduced pressure or full pressure)
  - push media into the correct position
  - check distance in the teach procedure

Further sensor:

- The CRASH sensor notices mechanic resistance during movements in gripping direction.

A reflex light sensor is mounted to the gripper for teaching. The light spot is reflected by the white teach marks, allowing to determine the size and location of the marks during the gripper movement.



*Fig. 4-6: Parallel gripper with Barcode Scanner*

### Barcode Scanner

A barcode scanner is integrated into the gripper. It checks the media Volsers. Using laser light, a scan line is projected onto the barcode label. The barcode scanner reads the reflection and immediately decodes it. The barcode scanner can read 200 times per second and decodes 200 times per second.

Power is supplied by a DC/DC converter board located on the rear (supply voltages  $\pm 12\text{ V}$ ,  $5\text{ V}$ ).

### 4.4.2 Quadro Tower

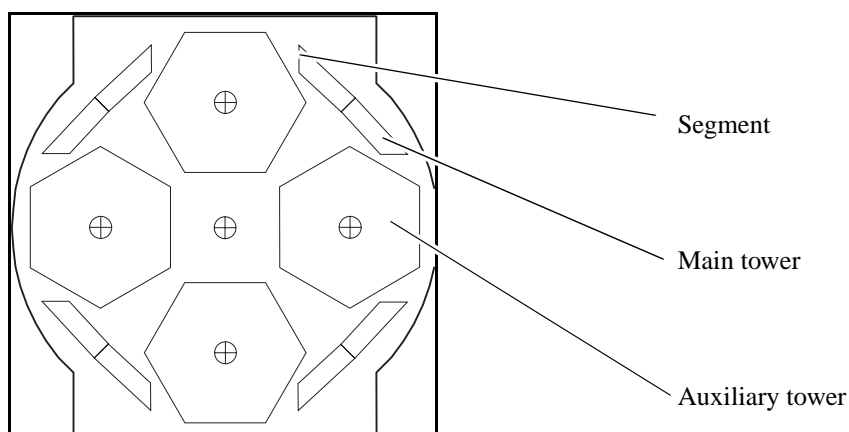
This storage tower consists of a main tower with four auxiliary towers.

These are driven by a special gear drive in the base frame. It is powered by two (brushless, electrically commutated) electronic motors with planetary gears. Positioning upon power-up is achieved by two reference point switches (behind the Quadro tower guard-door, next to the auxiliary tower's drive). Segments (shelf units) of various kind and defined overall height (e. g. 15 rows) are mounted onto this drive mechanism.

An auxiliary tower has 6 segments.

The main tower consists of 4 pairs of segments.

To ensure shortest possible access times the tower always rotates into the direction requiring the least amount of movement.



*Fig. 4-7: Quadro Tower*



### 4.4.3 Hexa Tower

#### Description

The Hexa towers can be mounted in pairs on the base plate. The Hexa towers are driven by a three-phase motor powering a rotary indexing table with 6 positions.

Positioning upon power-up is achieved by a reference point switch. Two positioning switches accomplish further positioning. When a position is reached the INPOS switch first detects the approximate position, before the CHECK switch finds the exact position. To make them easily accessible (for maintenance) the two positioning switches are located on the front of the Hexa towers.

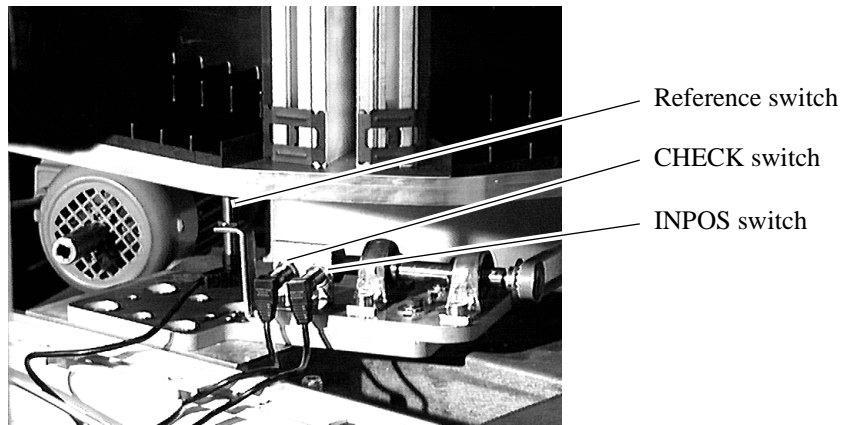


Fig. 4-8: Reference and Positioning Switches on Hexa Tower

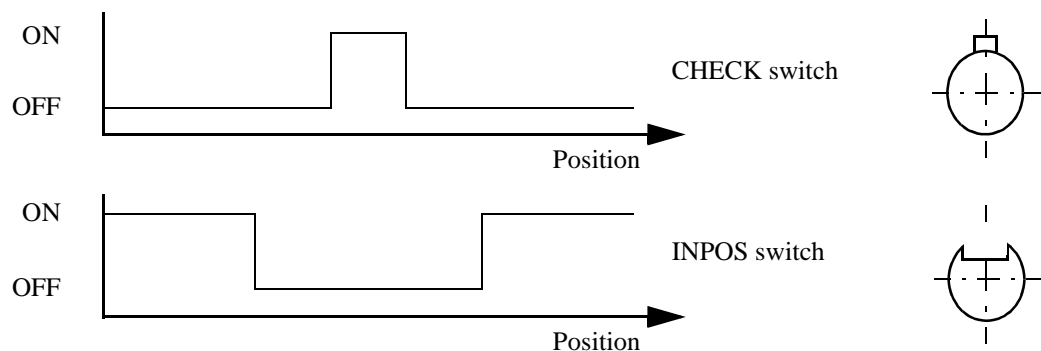


Fig. 4-9: Switching Sequence of Positioning Switches on Hexa Tower

The Hexa tower consists of 6 segments which can be quipped with different storage boxes of defined overall height (e. g. 15 rows).

### Gearing

The stepped rotation is achieved by means of a worm gear and cams. When the worm gear makes one revolution the Hexa Tower turns to the next segment.

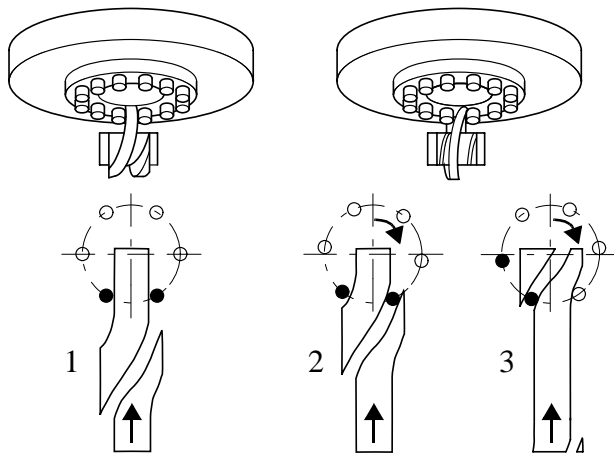


Fig. 4-10: Function of the Hexa Tower Gearing

#### 4.4.4 I/O Unit/B

Components (➡ Operator Guide)

- base frame
- shutters
- I/O door
- problem box
- distributor box
- handling box
- compressor
- operating panel

This unit is used to put new media into the archive and to eject currently not used or worn media (e. g. cleaning cassettes).

It is operated with the luminous push-button <ON> on the operating panel of the I/O unit.

The I/O door is integrated into the <EMERGENCY STOP> circuit together with the shutters, that is, if both are open, the system cannot be switched on or an <EMERGENCY STOP> will be triggered.



#### ATTENTION

**Be sure the I/O door is closed when you switch on the system.**

## 4.5 Product Description - Electric Components

### 4.5.1 Control Unit

The control unit (control cabinet) houses all components for control of motors, actuators and sensors.

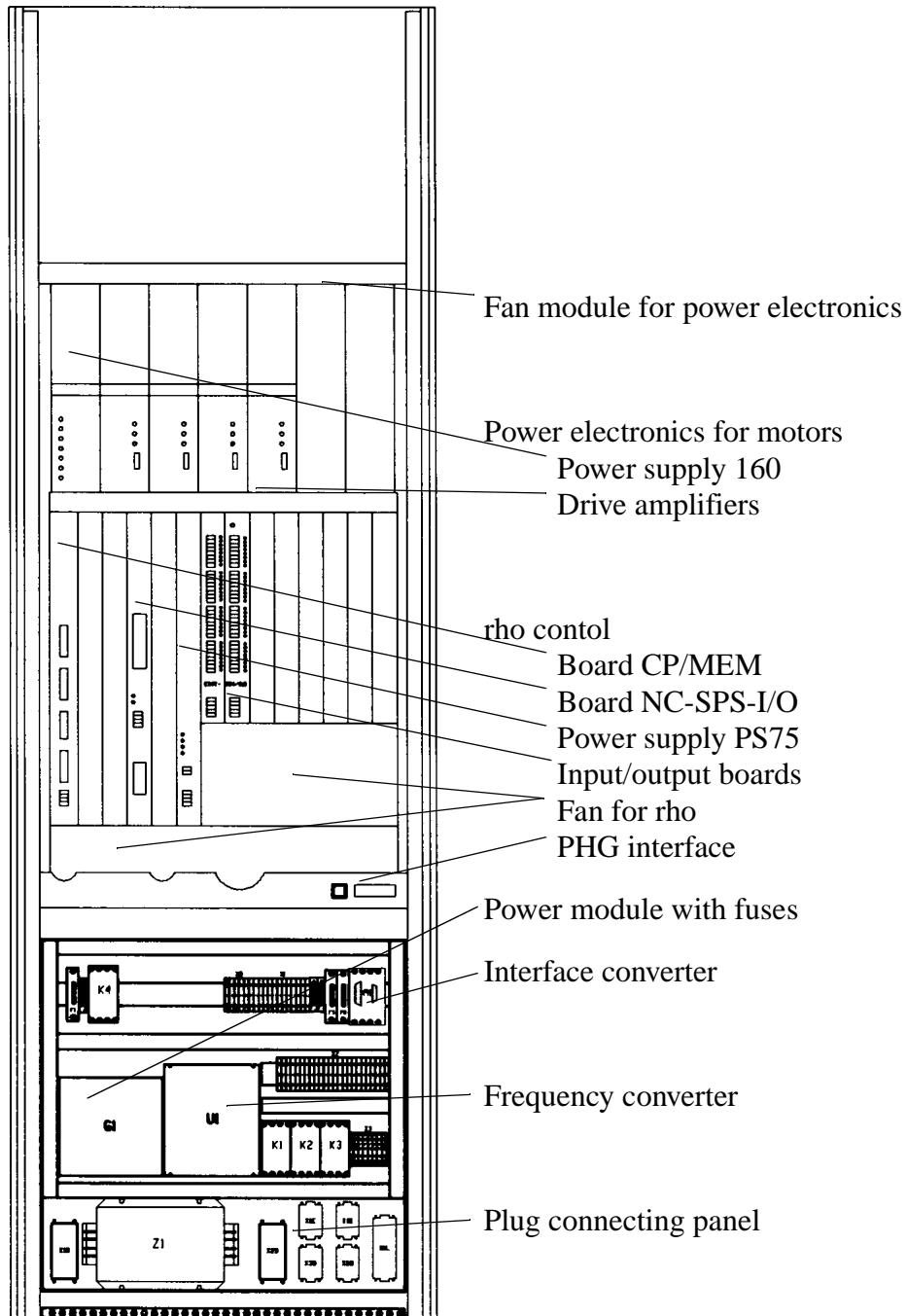


Fig. 4-11: Inside of Control Cabinet

### 4.5.2 Power Supply 160

---

The power supply generates the intermediate circuit direct current by rectifying and smoothing the input voltage. When the motor brakes rapidly the excessive energy is dissipated through a limiting resistor. The LED status display allows diagnosis when power fails.

The relay “power supply ready” drops out when error LED 4, 5 and 7 are on.

- LED1 (green): intermediate circuit voltage ready
- LED2 (green):  $\pm 15$  V DC ready (internal logic voltage generated from 24 V)
- LED 3 (green): 5 V DC ready (internal logic voltage generated from 24 V)
- LED 4 (red): excess temperature in power supply
- LED 5 (red): intermediate circuit voltage  $>400$  V DC
- LED 6 (yellow): limiting resistor active
- LED 7 (red): one phase missing (3-phase monitoring, not in use)

Reset of error messages:

- switch off the main switch and switch it on after 30 s.

Plug “Internal/External Regeneration”

- the plug must be plugged into “External Regeneration”.

Connector X5 (rear of 19’’rack)

- Pin 1: +24 V brake
- Pin 2: 0 V brake
- Pin 3: +24 V external power supply
- Pin 4: 0 V external power supply
- Pin 5: power supply O.K. relay
- Pin 6: power supply O.K. relay
- Pin 7: PE ground
- Pin 13: system ready (READY signal)
- Pin 14: system ready (READY signal)
- Pin 15: automatic mode for all axes (output 0.7)

Fuses

- F1: 2,5 A T for limiting resistor
- F2: 10 A T for internal logic voltage

Jumper “JW1”

- activates 3-phase failure monitoring (must not be plugged to E)

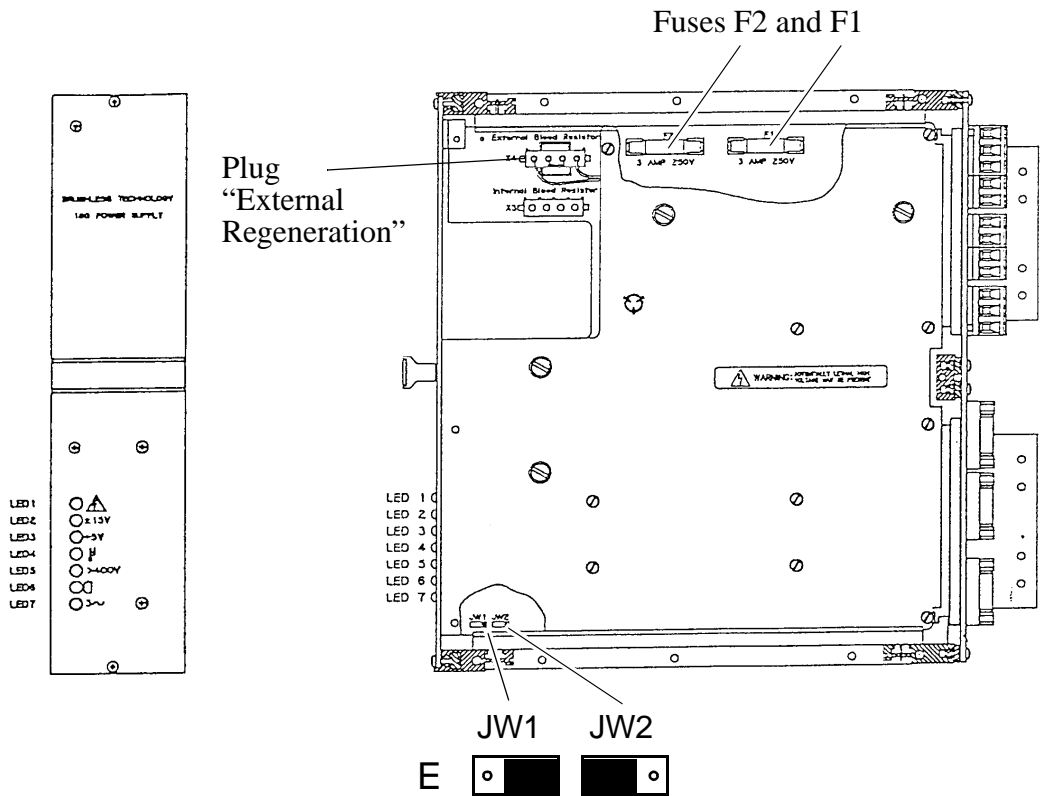


Fig. 4-12: Power Supply 160

### 4.5.3 Drive Amplifiers (Servo Controller T161)

The servo controller provides the electric commutation of the servo motors. It closes the speed regulating circuit and supplies a 3-phase sine-shaped motor current, which is in turn controlled by current regulators of high bandwidth.

The plug-on module (MCO-module) adapts the motor to the hardware.

The LEDs indicate errors.

- LED 1 (red): failure (look up the error in window **LOG Control Center**)
- LED 2 (yellow): torque limit active (amplifier overload)
- LED 3 (green): release (normal amplifier operation)

Connector X 6: connection to the PC (transfer of parameters with the program “Terminal”)

Jumper 2, 3 and 5 must be set „ON“ for activate communication on connector X 6



#### Information

**Diagnosis of the drive amplifier is possible via the program “Boschtrm” or the PHG (Mode 7.2).**

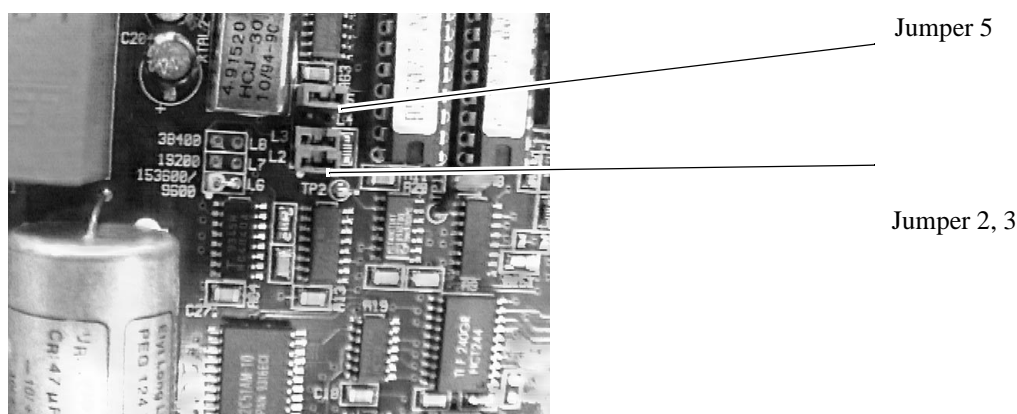


Fig. 4-13: Jumper for communication

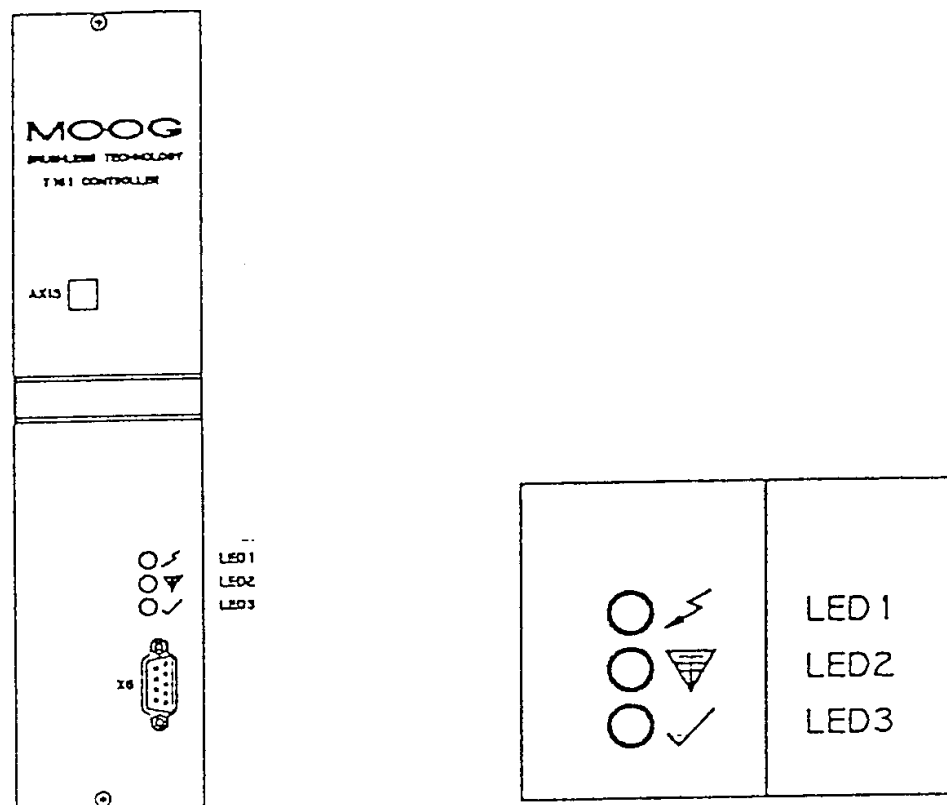


Fig. 4-14: Drive Amplifiers

### 4.5.4 rho

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rho is a modular control system for robots and their peripherals developed by Bosch.

#### Features

- operating system core EMX (Echtzeit(Realtime)-Multitasking-Executive)
- multitasking capability
- controls several kinematics (independent axis control)

#### Boards of rho

- board CP/MEM
- board NC-SPS-I/O (PIC board)
- power supply PS75
- input boards
- output board

## 4.5.5 Board CP/MEM

### Description

The processor and memory board has been developed for control of numerically controlled machine tools. It is equipped with the 32 bit processor module 32CG16 and a floating point processor FPU 32381 (15 MHz). The PHG-interface and the two serial interfaces on the connector X11 and X12 are served by the communication processor 8085. 1MByte of battery buffered CMOS-RAM is available as memory. Additionally a 512 kByte EEPROM memory is provided for storing machine parameters. The operating system is stored on an EPROM board behind a cover.

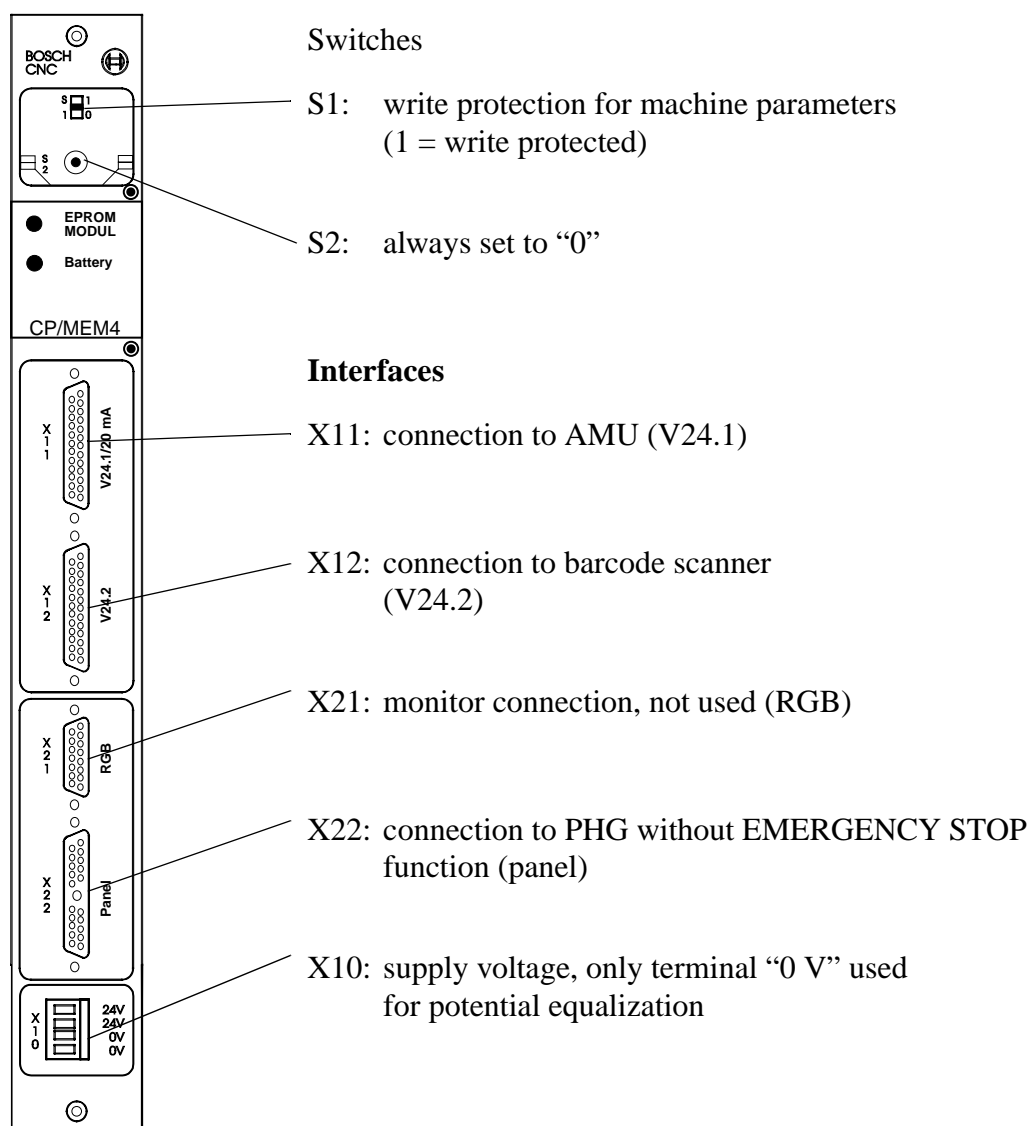


Fig. 4-15: Board CP/MEM 4



### Files Stored on CP/MEM Board

Files stored in the battery buffered RAM (exception: MPRHO3.BIN).

Depending on the configuration only the modules required are stored.

File Name	Contents
AMULESE.IRD	program module for communication
AMUSCHR.IRD	program module for communication
FBARCODE.IRD	program module for barcode reading
FLW3490.IRD	module for control of movements on drive 3490 and compatibles
FLWMULTI.IRD	module for control of movement on drives (optional)
FNEWGRIP.IRD	module for control of movements at the positioning point
PERMAN.IRD	program module for monitoring and error recognition, runs even when <CONTROL OFF>
FRACK.IRD	module for control of movements on compartments
FTEACH.IRD	module controlling the teach process
FTEST.DAT	dialog text for robot test program
FTEST.IRD	robot test program
EXPROG.DAT	file for automatic program start
HTURM.IRD	module for control of Hexa towers
INIT.IRD	main program
KONFIG.DAT	configuration file for handling unit
KOPPLUNG.DAT	internal file for communication with the PC
MPRHO3.BIN	system parameters of the control unit (on EEPROM)
QTURM.IRD	module for control of the first Quadro tower (optional)
QTURM2.IRD	module for control of the 2nd Quadro tower (optional)
TKONFIG8.DAT	configuration file for 2nd Quadro tower (optional)

### 4.5.6 Board NC-SPS-I/O (PIC Board)

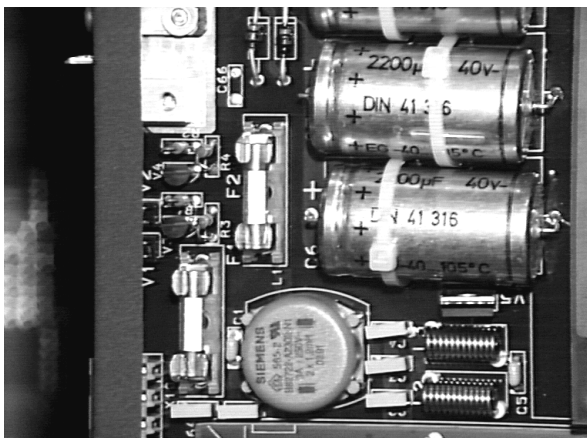
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PIC = programmable interface controller with CAN connection

This board facilitates direct coupling to the input and output boards of the combined rack. The board is internally connected to the I/O boards by the backplane.

The PIC file “IQ\_AMLE.P2X” is stored on the board.

Fuses F1 and F2 on the board: 3.15 A MT



*Fig. 4-16: Board NC-SPS-I/O: Fuses*

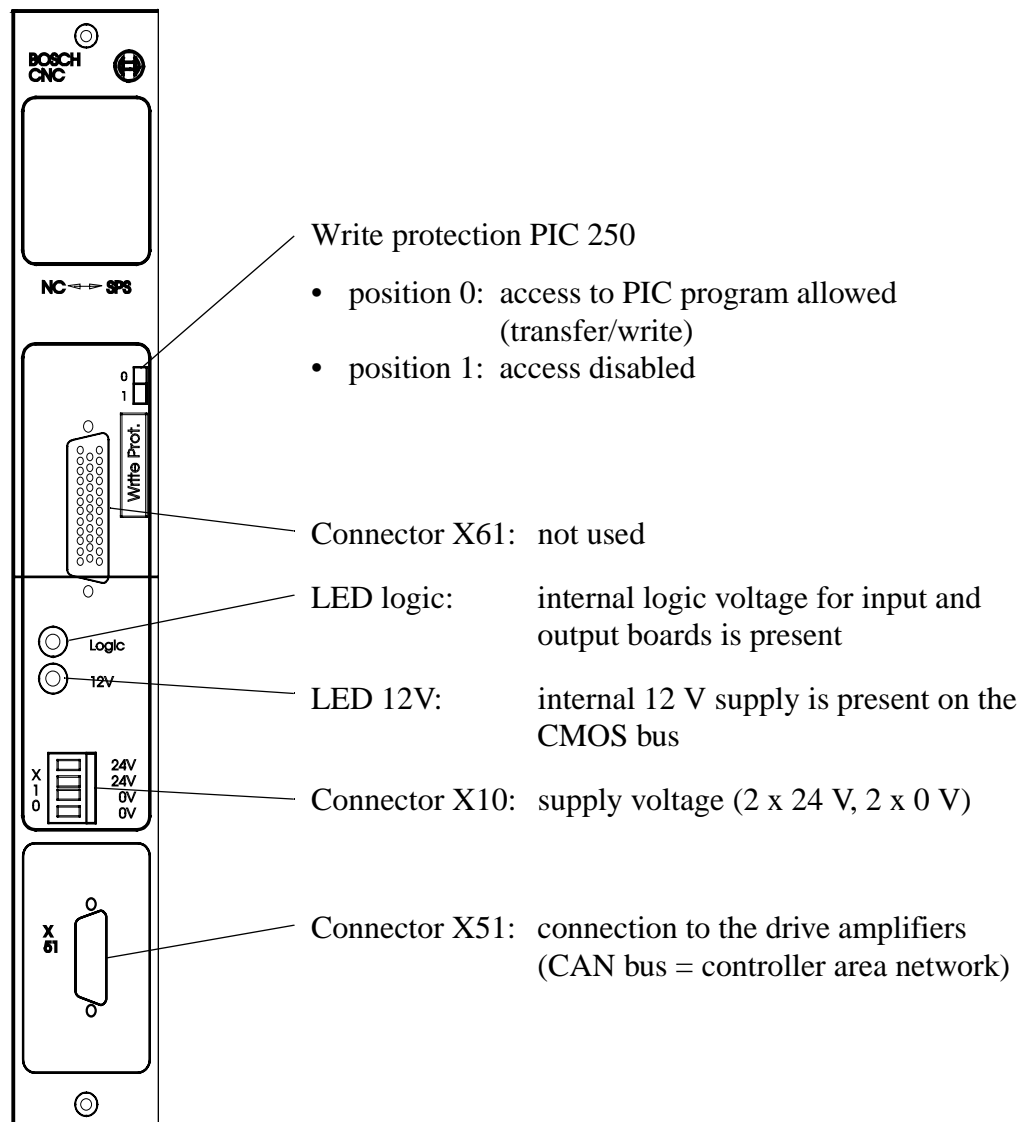


Fig. 4-17: Board NC-SPS-I/O

## 4.5.7 Power Supply PS75

The power supply generates the internal voltages for rho (logic control circuits of all modules, e. g. CP/MEM board).

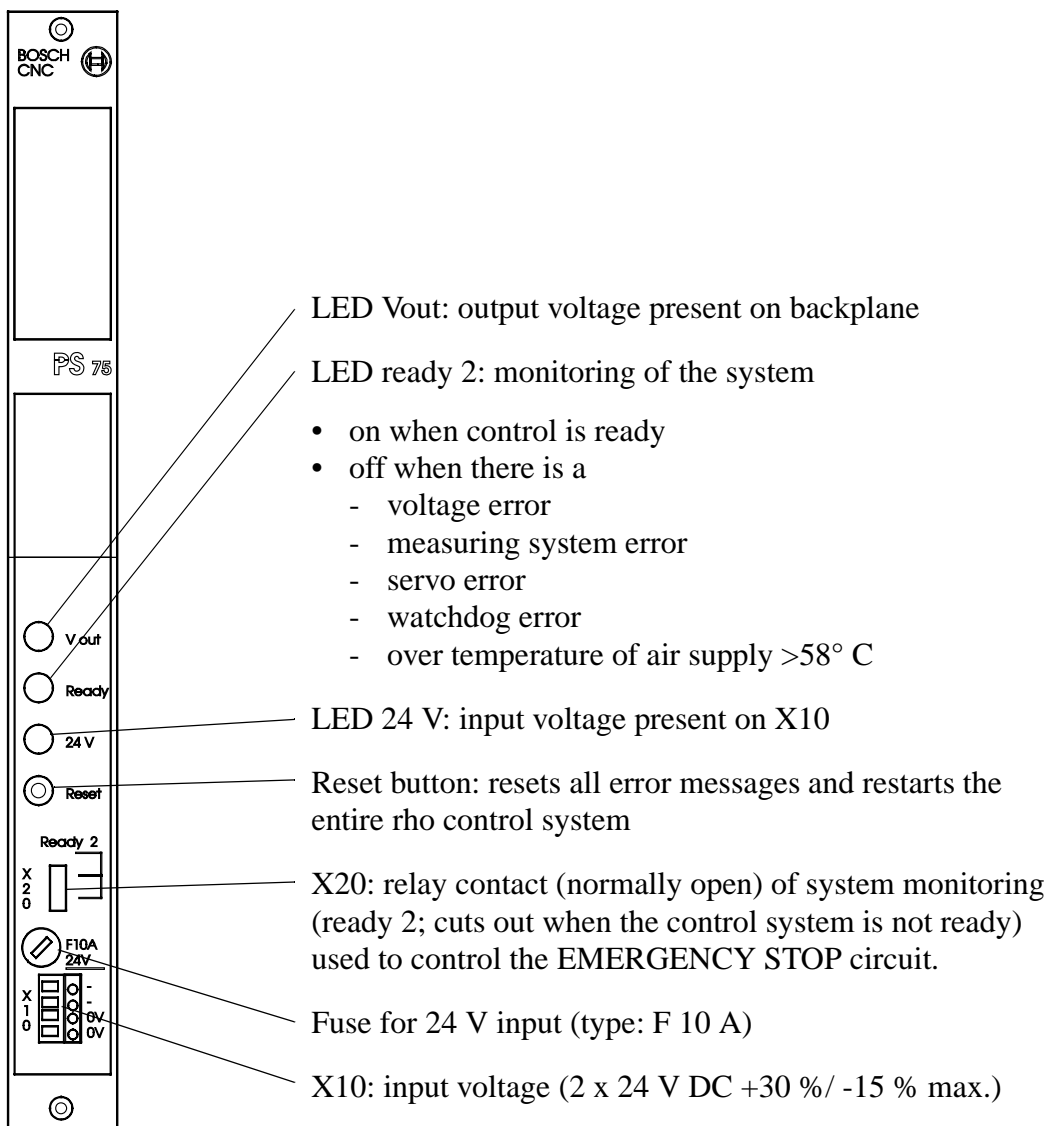


Fig. 4-18: Power Supply PS75

4.5.8 Input Boards

The input boards are tracing binary signals in the system.

Connection of inputs

The input signals are connected with four 8-fold plug-in terminals each (e. g. byte 0 ... byte 3)

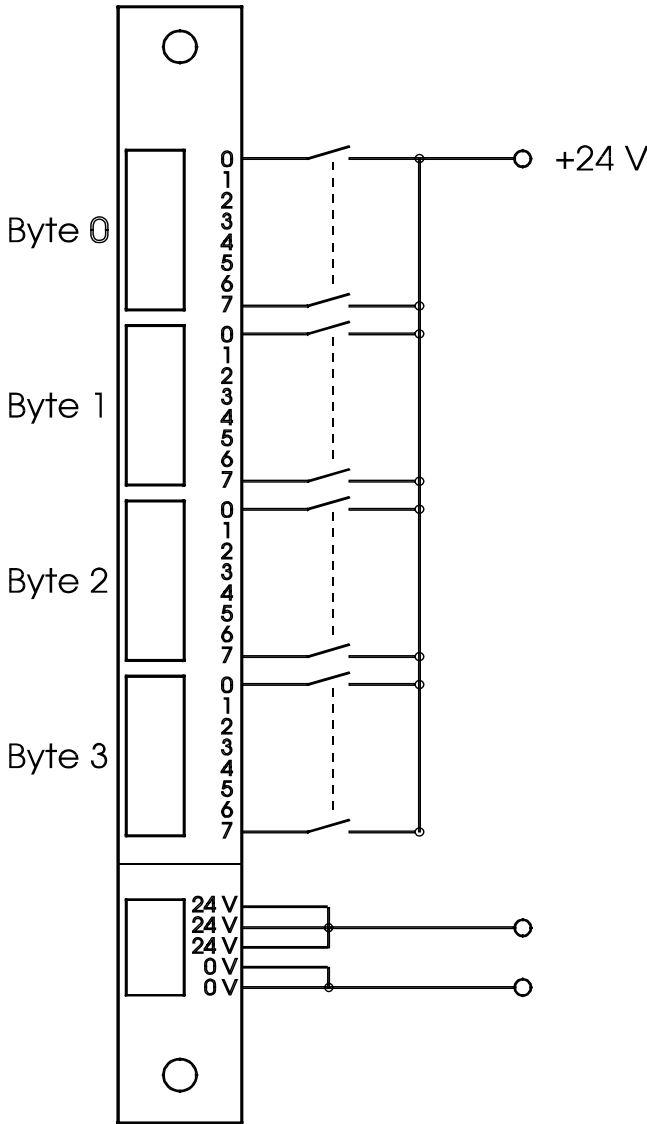
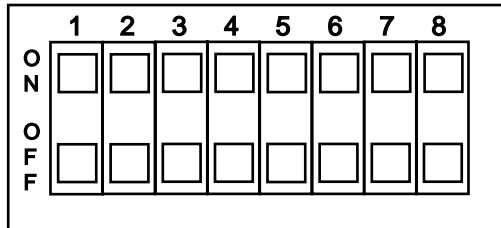


Fig. 4-19: Connection of Inputs

### Addressing the board

Each board has four 8-fold plug-in terminals. Each 8-fold plug-in terminal constitutes one input byte for the control system. The DIP switch on the bottom right of the board defines the address of the first byte in binary code, that is, for the top 8-fold plug-in terminal. When several boards are used the address of the first byte must be set to the next vacant address.



*Fig. 4-20: DIP Switch for Board Address Adjustment*

#### Addresses

- board 1: address 0 (all switches “OFF”)
- board 2: address 4 (only switch 3 “ON”, remaining switches “OFF”)

### Input configuration

Input Board 1	Input Board 2 (only old systems)
0.0 set-up operation 0.1 handling box 1 0.2 handling box 2 0.3 handling box 3 0.4 handling box 4 0.5 EMERG. STOP circuit, not 0.6 control ON 0.7 power supply 160 release	4.0 Hexa tower 1 reference 4.1 Hexa tower 1 inpos 4.2 Hexa tower 1 check 4.3 Hexa tower 2 reference 4.4 Hexa tower 2 inpos 4.5 Hexa tower 2 check 4.6 Hexa tower 3 reference 4.7 Hexa tower 3 inpos
1.0 reference point 1st axis 1.1 reference point 2nd axis 1.2 reference point 3rd axis 1.3 reference point 4th axis 1.4 reference point 1st main tower 1.5 reference point 1st aux. tower 1.6 pressure too low 1.7 reference point hexa tower 1-4	5.0 Hexa tower 3 check 5.1 Hexa tower 4 reference 5.2 Hexa tower 4 inpos 5.3 Hexa tower 4 check 5.4 handling box 1 5.5 handling box 2 5.6 handling box 3 5.7 handling box 4
2.0 crash, not 2.1 pusher in front 2.2 pusher in back 2.3 reserve 2.4 teach sensor 2.5 reserve 2.6 reference point 2nd main tower 2.7 reference point 2nd aux. tower	6.0 Hexa tower stands still 6.1 reserve 6.2 reserve 6.3 reserve 6.4 reserve 6.5 reserve 6.6 reserve 6.7 reserve
3.0 reserve 3.1 INPOS Hexa tower 1-4 3.2 CHECK Hexa tower 1-4 3.3 problem box empty 3.4 shutter is up 3.5 I/O door closed + locked 3.6 shutter is down 3.7 frequency converter 0 Hz	7.0 reserve 7.1 reserve 7.2 reserve 7.3 reserve 7.4 reserve 7.5 reserve 7.6 reserve 7.7 reserve

#### 4.5.9 Output Board

The output board outputs binary signals at 24 V, 0.5 A.

##### LED

excessive current on one of the outputs

##### Connection of outputs

The outputs are connected with four 8-fold plug-in terminals each (e. g. byte 0 ... byte 3)

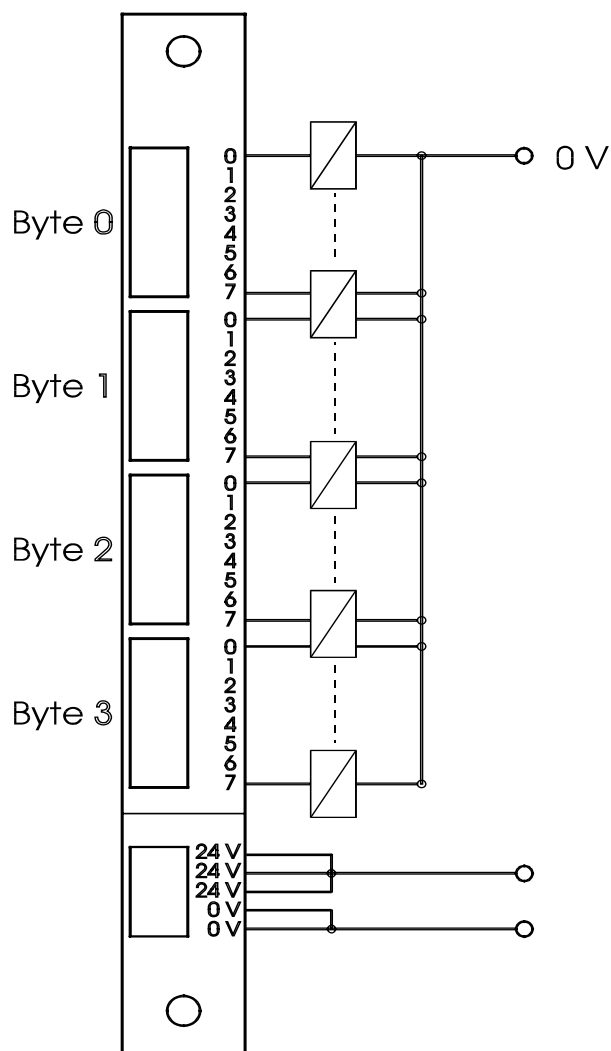
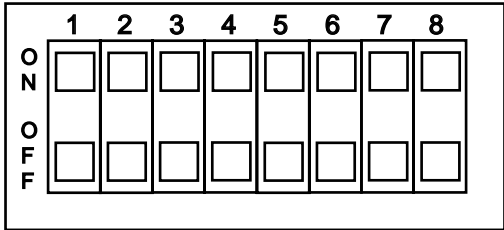


Fig. 4-21: Connection of Outputs



**Adressing of the board**

The board has four 8-fold plug-in terminals. Each 8-fold plug-in terminal constitutes one output byte for the control system. The DIP switch on the bottom right of the board defines the address of the first byte in binary code, that is, for the top 8-fold plug-in terminal.



*Fig. 4-22: DIP Switches for Board Address Adjustment*

The address of the board is 0 (all switches “OFF”).

## Output configuration

Output Board	
0.0	program running
0.1	PIC running
0.2	permanent task running
0.3	reserve
0.4	reserve
0.5	reserve
0.6	reserve
0.7	100 % output
1.0	gripper vertical
1.1	gripper horizontal
1.2	gripper semi-open
1.3	gripper open
1.4	pusher reduced pressure
1.5	pusher full pressure
1.6	tilt gripper (7°)
1.7	teach sensor active
2.0	Hexa tower left
2.1	Hexa tower fast running
2.2	frequency converter release
2.3	Hexa tower 1 ON
2.4	Hexa tower 2 ON
2.5	Hexa tower 3 ON
2.6	Hexa tower 4 ON
2.7	reserve
3.0	gripper center (Mixed Media)
3.1	reserve
3.2	reserve
3.3	reserve
3.4	shutters up
3.5	I/O signalization
3.6	I/O lock
3.7	release I/O + problem box

### 4.5.10 Handheld Programming Unit (PHG)

---

#### About the PHG

The PHG has an LCD display (4 x 20 characters) and a keypad. Additionally, it is provided with a confirm button (dead man) and an <EMERGENCY STOP> button (☞ “<EMERGENCY STOP> Buttons” from page 3 - 8).

Depending on control by the operating system, a number of system functions can be released with the PHG (☞ menu tree of rho on the following pages).

A number of operating system functions (not automatic programs) can be used only in the operating mode “set-up” of the rho control (24 V on input board 1 input 0.0 connected).

#### Connecting the PHG

Socket: on the rho control unit next to the button



#### ATTENTION!

**Possible interruption of the EMERGENCY STOP circuit.**

**If the AML/E system is switched on. Press the button**



**when you insert the plug. This bridges the EMERGENCY STOP circuit.**

## Operating the PHG

Most of the keys on PHG have three functions.

Switch-over is made with **SHIFT** or **ALT** .

The basic configuration of the keys is different in the various modes.

Operating PHG functions requires some practicing.

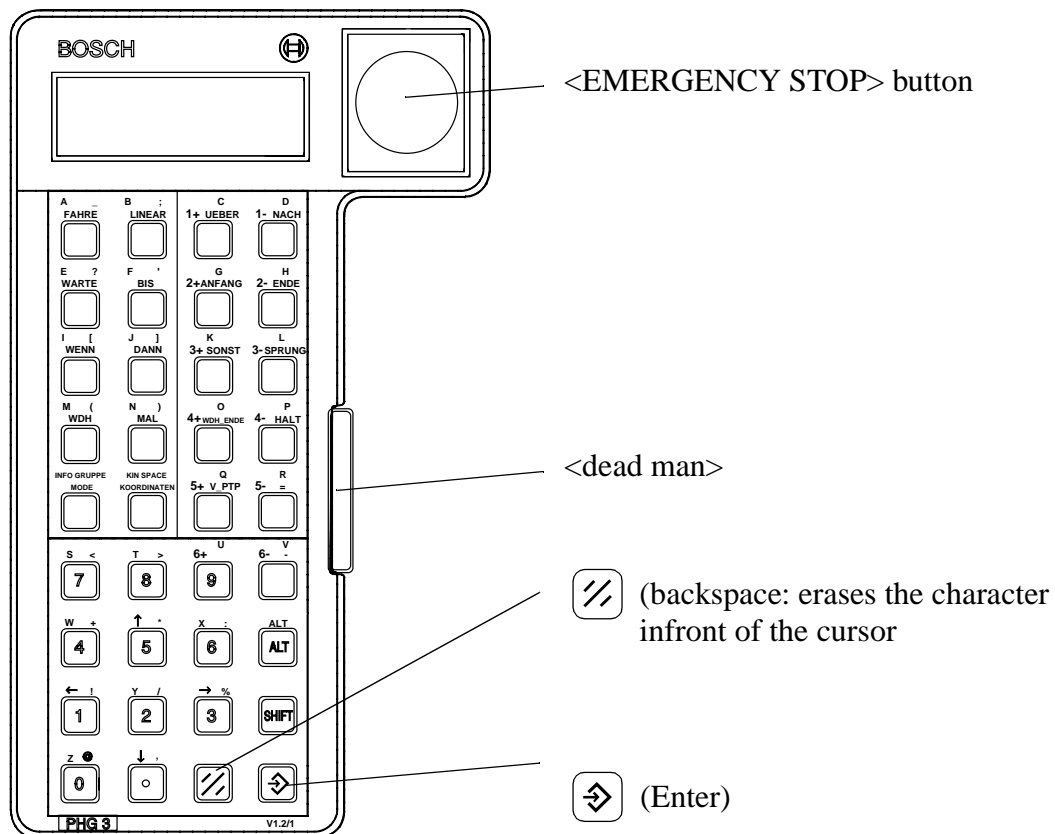


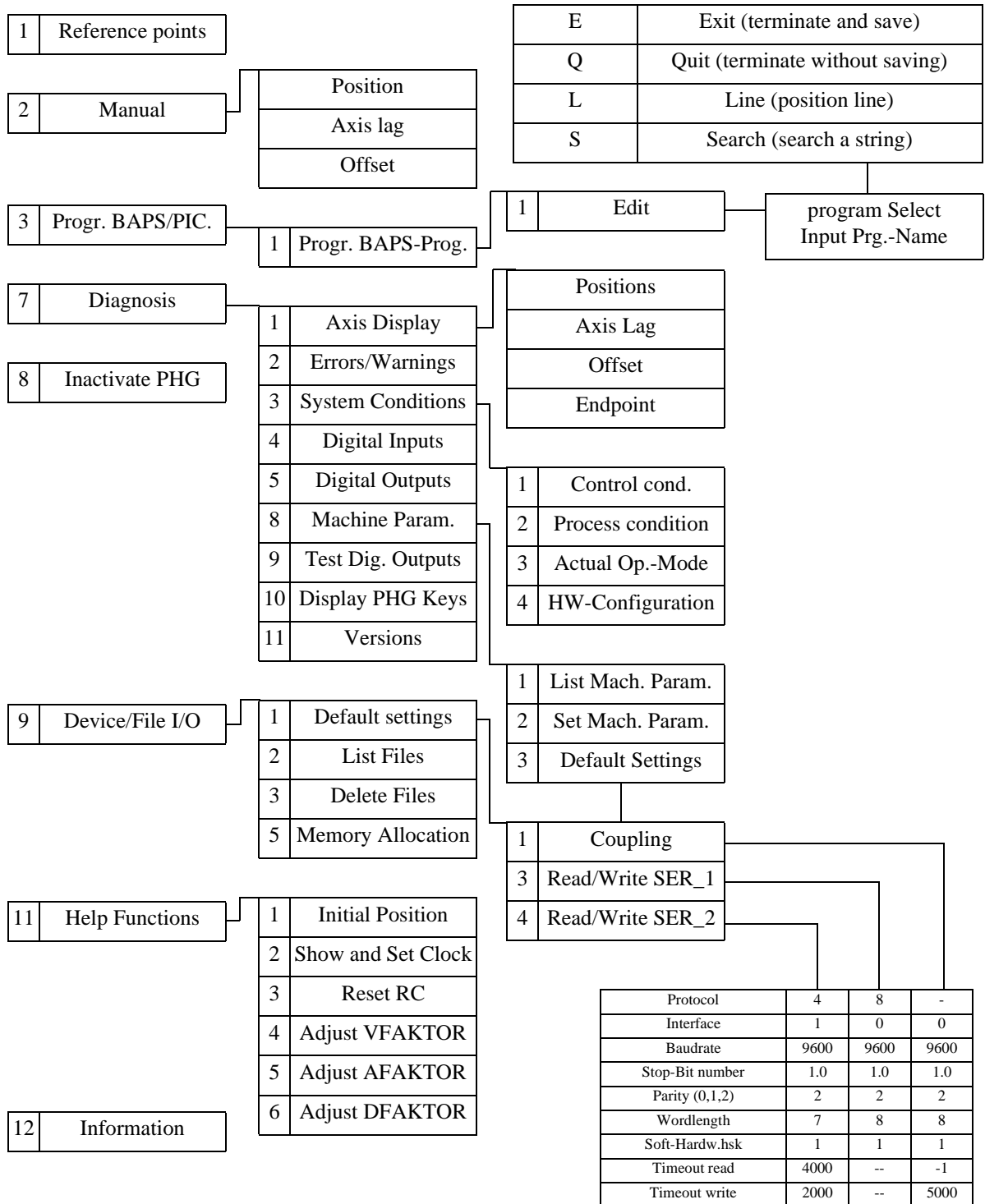
Fig. 4-23: Handheld Programming Unit (PHG)

### Menu tree of rho PHG operating system



Prompt display after **MODE** input: mode : #

Select with **MODE** , **No** , **↔** , Cancel with **←**



### 4.5.11 Frequency Converter MicroMaster

The frequency converter controls the speed of the 3-phase drives of the Hexa towers with an intermediate voltage circuit. A microprocessor in the MicroMaster controls the process. The system is adapted by a number of parameters which are always adjusted by ADIC/GRAU Storage Systems. The frequency converter is controlled by binary signals from the rho control system. Control output to the motors and reversing of direction is switched by relays.

Errors are indicated on the display as numeric codes following an “F” (e. g. F001) (→ page 11 - 11).



Fig. 4-24: Frequency Converter MicroMaster

## 5 Operating the AML/E System

---

### 5.1 Overview of AMU Commands

---

Inputs at the operating console of the AML/E system (AMU operating console) have the same priority as host commands.

Input at the AMU must be restricted to the following situations:

- when host communication fails (“AUTO”).
- when the handling unit fails (manual update of the archive catalog after manual intervention ➡ Operator Guide).



#### **Information**

**All non-executable commands or options are displayed with a shadow.**

#### 5.1.1 Using the Operator Console

---

Layout and operation conform to SAA standards.

It is controlled by

- the keyboard
- the mouse

Further information is found in the OS/2 manuals.

### 5.1.2 Starting the Operating Console AMU

---



#### Information

**Do this only when the operating console AMU is not shown on the monitor or has been quit unintentionally.**

- a) Press <CTRL> + <ESC> (process list)
- b) Check whether AMU and KRN have already been started

If only KRN.EXE has been started:

- c) Change to an OS/2 window
- d) Change to the AMU directory c:\amu (command `cd \amu`)
- e) Enter `con` and confirm the input by pressing <ENTER>

If only AMU has been started:

- c) Change to an OS/2 window
- d) Change to the AMU directory c:\amu (command `cd \amu`)
- e) ENTER `krrn` and confirm the input by pressing <ENTER>
- f) Press <CTRL> + <ESC> (process list) and change to the AMU process

If none of the two processes has been started:

- c) Change to an OS/2 window
- d) Enter `startup` and confirm the input by pressing <ENTER>



5.1.3 Window Layout

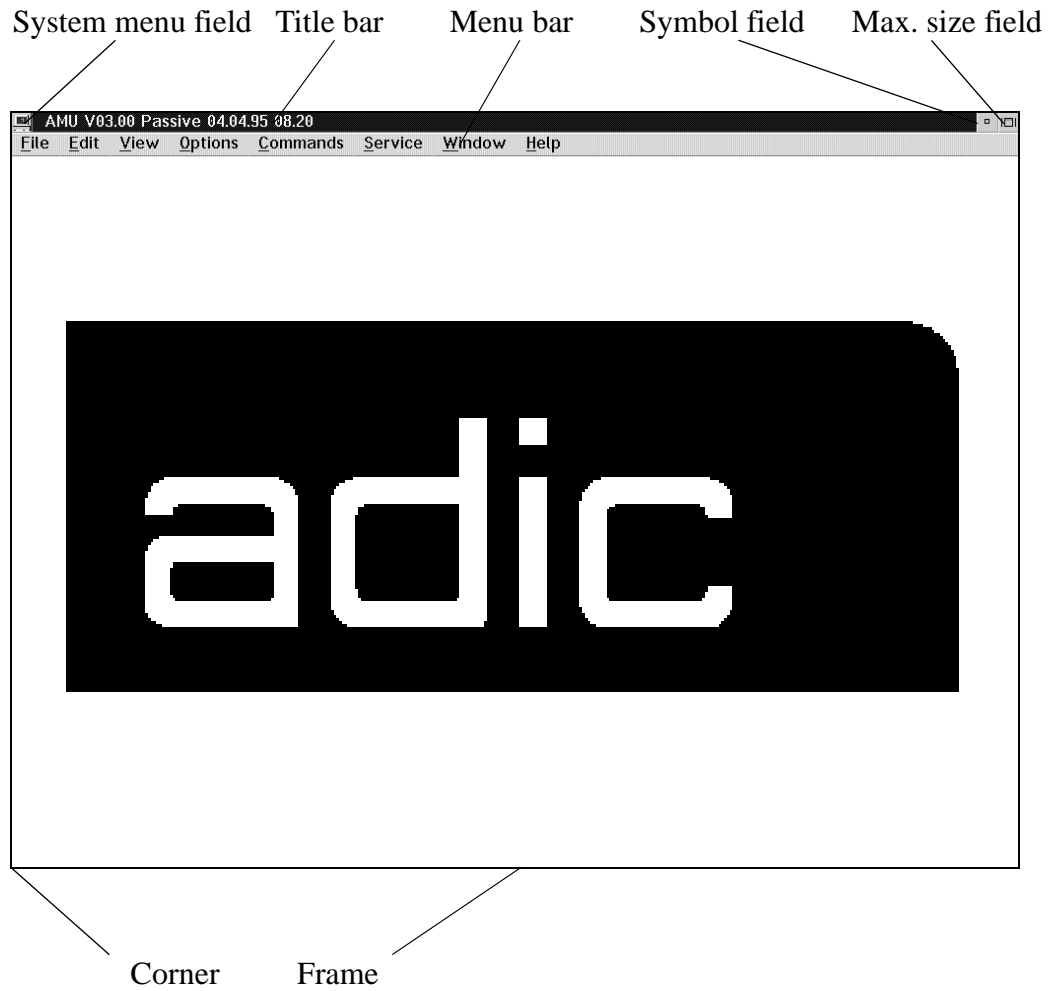


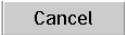
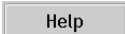
Fig. 5-1: Window Layout of the Operating Console



Information

When the window is active the title bar has a blue background. When the window is inactive the title bar has a grey background.

The following functions are the same in all windows:

Button	Function
	Cancels the current function and closes the window.
	Opens the online help.

### 5.1.4 Selecting a Command

---

With the mouse:

- a) move the mouse pointer to the desired menu in the menu bar
- b) click on the menu; the menu opens
- c) click on the command in the menu; the command window opens

With the keyboard:

- a) press the <ALT> key and the underlined letter in the menu bar. The menu opens
- b) Now press the underlined letter in the menu to select the command

With a command code:

- a) If a key or a combination of keys is specified following the command you can directly select the command with it

### 5.1.5 Altering a Window's Size

---

Resizable windows have a frame all around (e. g. Trace window).

- a) Move the mouse to any corner of the active window.  
The mouse pointer changes into a double arrow
- b) Press the mouse button and pull the window to the desired size while you keep the mouse button pressed

### 5.1.6 Moving a Window

---

- a) Move the mouse pointer onto the title bar
- b) Move the window while you keep the mouse button pressed

### 5.1.7 Closing a Window

---

- a) Close the window by a double click on the system menu field



### **Information**

**Description of AMU Operating menu (➞ ARG).**

## 5.2 Teaching

---



### Information

- Teaching means to instruct the robot system as to its functions.
- Teach labels are square white marks on defined spots.

### 5.2.1 When Do I Have to Teach?

---

#### Initial teaching

- For first operation of the AML/E system.
- When the AML/E system has been extended (e. g. further drives).

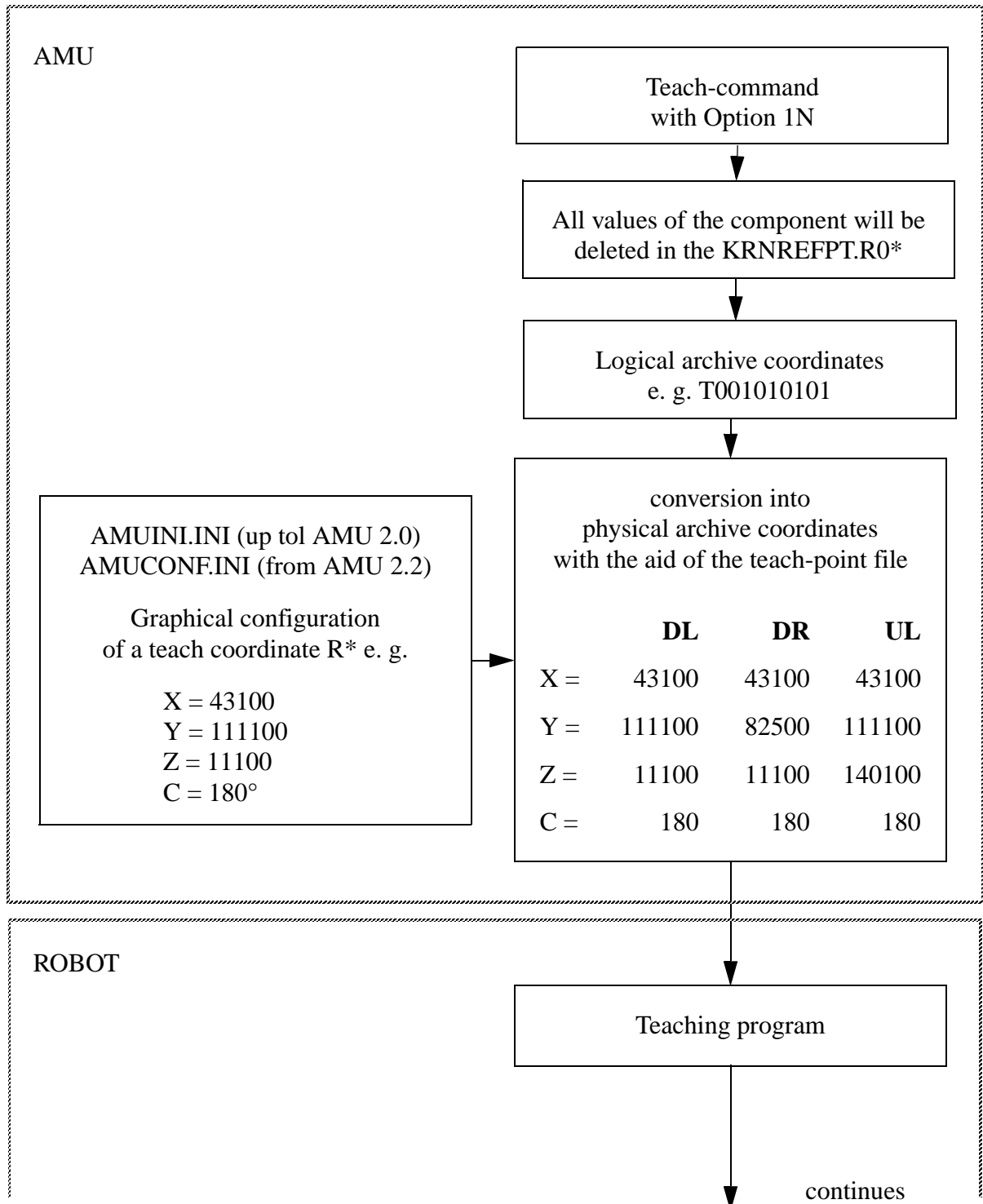
#### Reteaching

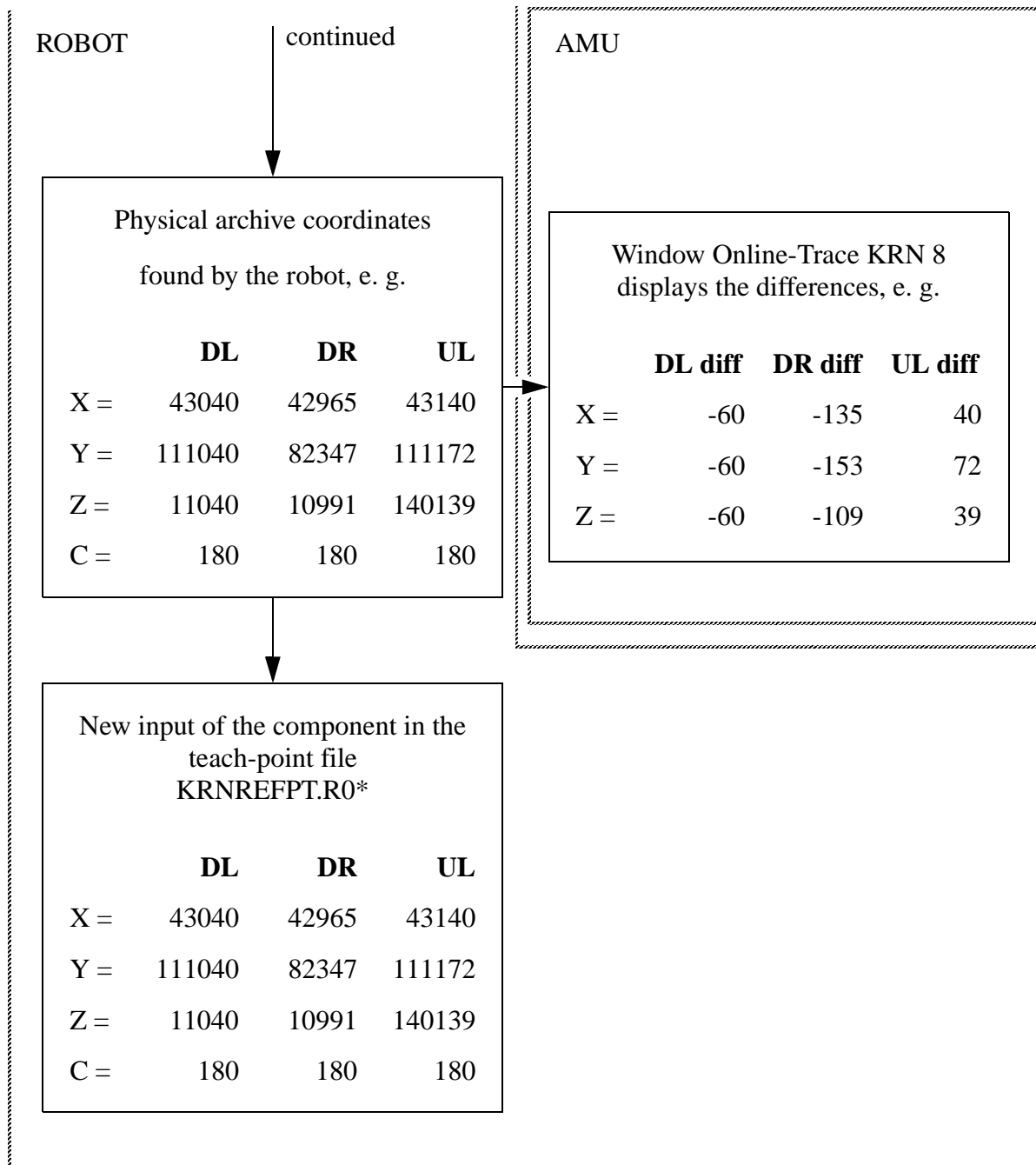
After mechanical changes on the AML/E system  
(e. g. replacement of components).

5.2.2 Procedure for Teaching

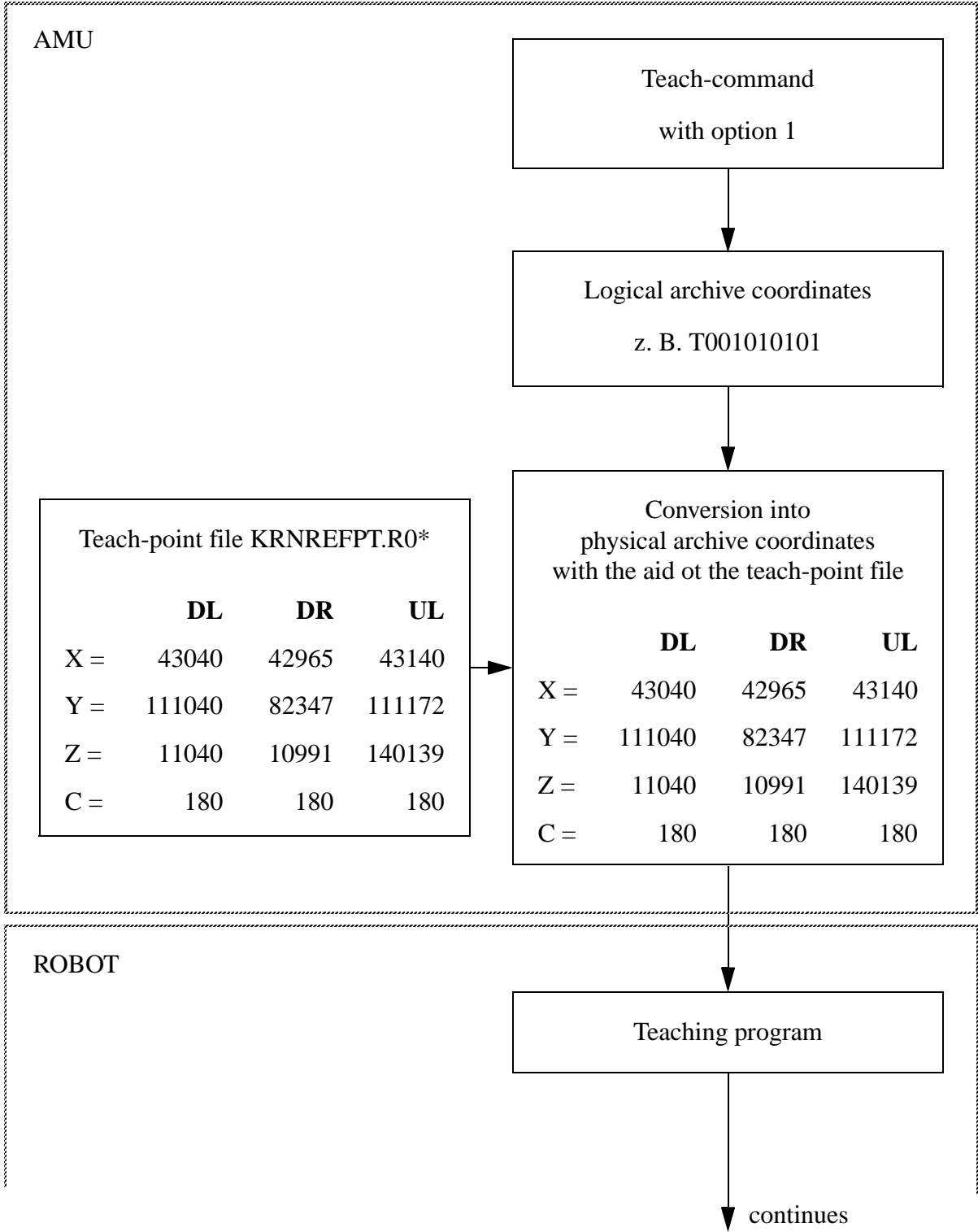
Initial teaching (option 1N)

- a) Teach first component segment with option 1N,  
teach the remaining segments with option 1.





Reteaching of a segment (option 1)



ROBOT

continued

Physical archive coordinates  
found by the robot, e. g.

	<b>DL</b>	<b>DR</b>	<b>UL</b>
X =	43036	42971	43140
Y =	111040	82357	111172
Z =	11080	10163	140178
C =	180	180	180

AMU

Window Online-Trace KRN 8  
displays the differences, e. g.

	<b>DL diff</b>	<b>DR diff</b>	<b>UL diff</b>
X =	-4	6	0
Y =	0	10	3
Z =	40	828	39

Correction of the component segment  
in the teach-point file  
KRNREFPT.R0\*



















	<b>DL</b>	<b>DR</b>	<b>UL</b>
X =	43036	42971	43140
Y =	111040	82357	111175
Z =	11080	10163	140178
C =	180	180	180





### 5.2.3 Procedure for Initial Teaching

---

To teach a point the first time or to find the teach values for the configuration proceed as follows.

- a) Switch the main switch on
- b) Press <CONTROL ON>
- c) Wait until the reference movements are completed
- d) Call up the robot test program: press  +  + <dead man>
- e) Press  + <dead man> (TEST)
- f) Press  + <dead man> (Move Axes)
- g) Press  + <dead man> (Move Robot)
- h) Press  + <dead man> (Search Teach-Label)
- i) Press 
- j) Move the robot roughly to the position of the left (bottom) teach label by entering the coordinates
  - X (0 - 210) 1st axis or press 
  - Y (0 - 1200) 2nd axis or press 
  - Z (0 - G\_Z\_Maxlimit, depending on 12R,15R or 18R) or press 
  - C (0 --> no movement, 1 --> position 0°, 2 --> position 90°, 3 --> position 180°, 4 --> position 270°)
- k) After entering  keep the <dead man> button pressed until the movement stops. (0 generally means no change of position for the respective axis).
- l) Press 
- m) Move the robot to the teach label (position the centre of the yoke onto the label, distance 0.5 to 5 cm) by moving the axes 1 - 3 with the buttons
  -  ,  + <dead man>
  -  ,  + <dead man>
  -  ,  + <dead man>

- When label position reached, press  for cancel moving
- n) Start the search by pressing .
- o) Read off the coordinates
- p) Enter the coordinates into the Graphical configuration of the AMU
- q) Save the configuration
- r) Close the test program
- s) Shutdown AMU
- t) Start AMU
- u) In the menu **Service** select the command **Teach MTCGdialog**:
- v) the window **Graphical Teaching** opens
- w) Selecting the component:
  - click twice with the left mouse button - the component is shown in blue
  - keep <CTRL> pressed, and select robot and green connection, is shown in red
- x) Start teaching with **Start Teach** (initial teaching)
- y) Check, that the teach role inserted in the drive on the display
- z) Wait for positive confirmation (component appears green)
- aa) Selecting the component:
  - click once with the left mouse button - the component is shown in red
  - keep <CTRL> pressed, and select robot and green connection, is shown in red
- ab) Start teaching with **Start Teach** (re-teaching)
- ac) Check, that the teach role inserted in the drive on the display
- ad) Wait for positive confirmation (component appears green)
- ae) Repeat the above steps for all further components
- af) Cancel the window **Graphical Teaching** with Exit

### 5.2.4 Teach Labels

---

#### Teach label data

Size: 8 x 8 mm

Colour: white on black background

The coordinates of the teach label consist of

- the basic value in AMUCONF.INI for one label per unit,
- the fine values for all teach labels used in the file KRNREFPT.R01

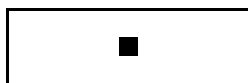
#### Drives



#### ATTENTION!

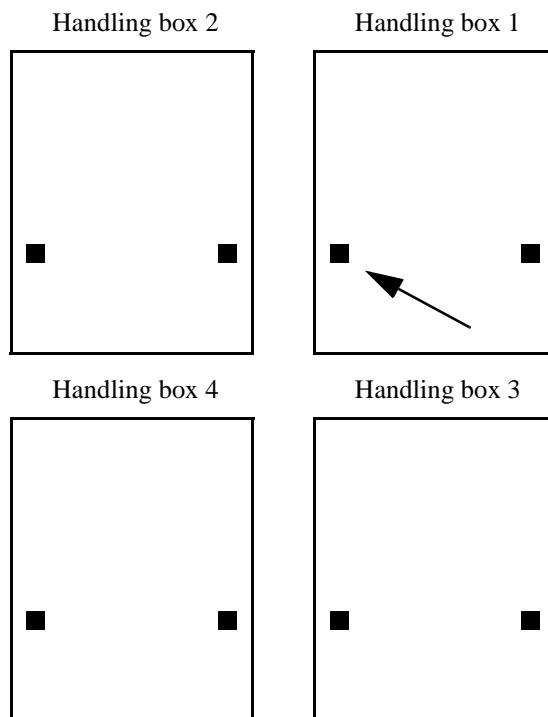
**Teach each drive slot separately. This is required even when several drives are mounted in the same housing.**

- Switch the drive off.
- Insert the teach rule into the drive until stop:
  - on 3x80 or 3x90 drives with ACL (Automatic Cartridge Loader): insert the teach rule one position above the draw-in position
  - on 3x80 drives with cover: close the cover



*Fig. 5-2: Teach rule with Teach Label*

The coordinates refer to the teach label.

**I/O unit/B**

*Fig. 5-3: Teach Labels on the Handling Boxes (inside)*

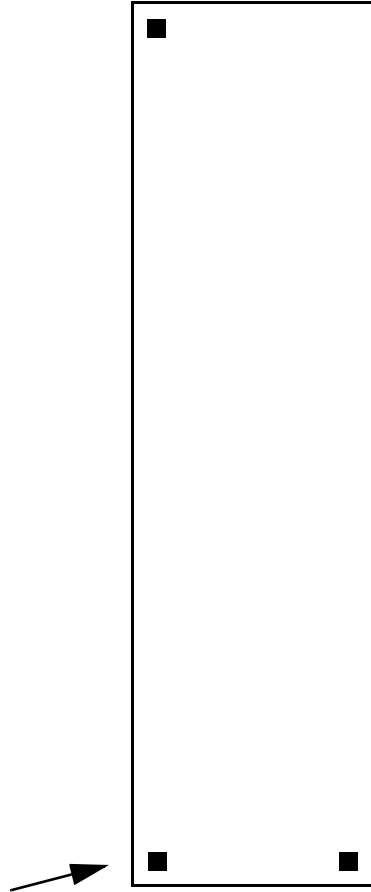
The coordinates refer to the teach label indicated.

**Problem box**

*Fig. 5-4: Teach Labels on the Problem Box*

The coordinates refer to the left teach label.

### Tower segment



*Fig. 5-5: Teach Labels on a Tower Segment*

The coordinates refer to the bottom left teach label.



#### **Information**

**The top right teach label is not used.**

5.2.5 AMU-Commands

Single command

To teach a single object, e. g. a tower segment or a drive proceed as follows.

a) Select **Teach single command**

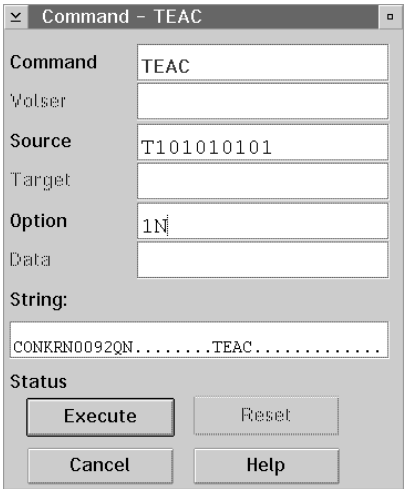
Window	Field	Explanation
	<b>Command</b>	Displays the selected command, here TEAC.
	<b>Source</b>	10digit source coordinate (e. g. T001010101).
	<b>Option</b>	Parameters specifying the details of the TEACH-command. <ul style="list-style-type: none"><li>• on AML/E only 1, 1N</li><li>• on AML/2 1, 1N and on twin systems also 2, 2N</li></ul> 1N or 2N = first teaching (All data of the component in KRNREFPT.R01 will be erased. The target coordinates are used from the configuration. The entire component must be taught afresh.)
	<b>String:</b>	1 = correction of coordinates (the data in KRNREFPT.R01 are corrected). Displays the command string. Composition of the string (⇐ ARG)
	<b>Status</b>	Displays messages.
	<b>Execute</b>	Executes the command.
	<b>Reset</b>	Interrupts the command transfer.

Fig. 5-6: window Command

Graphical teaching

For graphically supported teaching, of e. g. a Quadro tower, several drives or the complete system.

a) Select MTCG Dialog

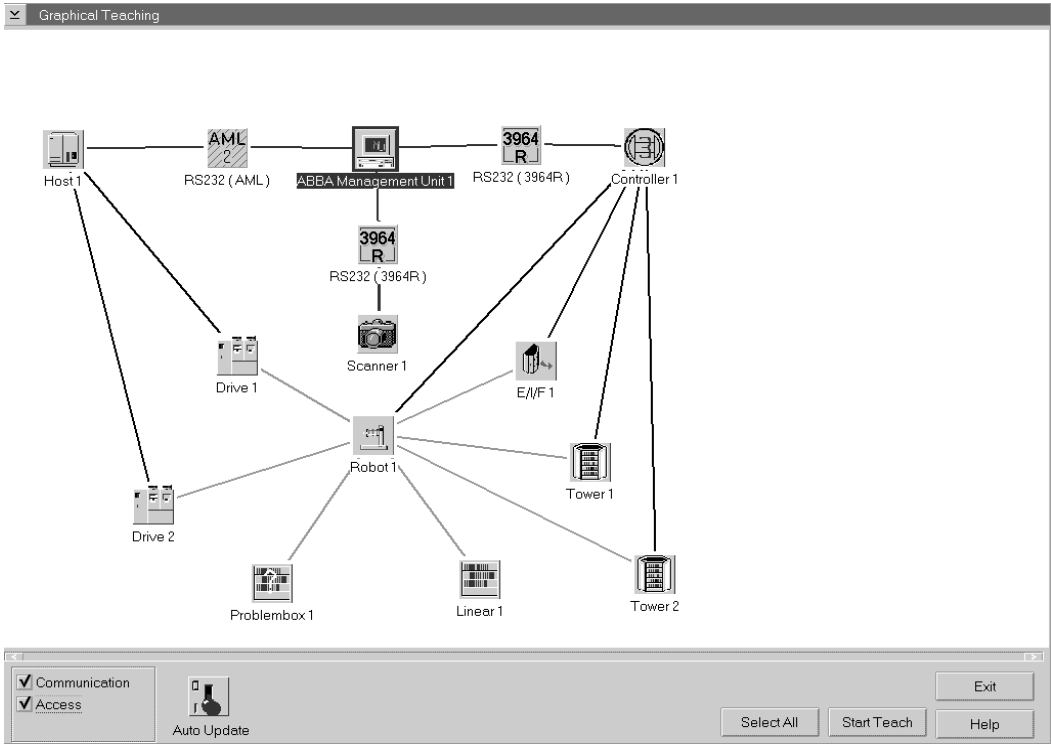



Fig. 5-7: Window Graphical Teaching

Command	Explanation
Connection:	Switch allowing to display or hide the connections (👉 ARG) <ul style="list-style-type: none"><li>• <b>Communication:</b> data connection</li><li>• <b>Access:</b> mechanic access</li></ul>
Auto Update	Here no function
Select All	Selects all components.
Unselect All	Unselects all selected components.

Command	Explanation
	<p>Selecting a single component:</p> <ul style="list-style-type: none"> <li>• teach (1): click once with the left mouse button - the component is shown in red</li> <li>• re-teach (1N): click twice with the left mouse button - the component is shown in blue</li> </ul> <p>To select several components keep &lt;CTRL&gt; pressed.</p>
	<div>  <p><b>Information</b></p> <p><b>To determine which robot teaches the component you must select the robot, the component and the connection.</b></p> <p><b>When you teach a drive the system prompts you to check if the teach rule has been inserted.</b></p> <p><b>How to proceed with a twin robot:</b></p> <ul style="list-style-type: none"> <li>• <b>robot 1</b> begins with the first tower in ascending order</li> <li>• <b>robot 2</b> begins with the last tower in descending order</li> </ul> </div>
	<p>After teaching:</p> <ul style="list-style-type: none"> <li>• component appears green: no errors</li> <li>• component appears dark brown: error message and prompt <ul style="list-style-type: none"> <li>- <b>Retry</b>: teach once more</li> <li>- <b>Ignore</b>: ignore error and teach the next component</li> <li>- <b>Abort</b>: abort the teaching (all components)</li> </ul> </li> </ul>
<b>Start Teach</b>	Start the teach routine for the selected components.
<b>Stop Teach</b> (during teaching only)	Stop the teach routine.



### 5.2.6 Problems during Teaching

---

Problem	Cause	Solution
Teach label not recognized	teach label dirty	a) Clean the teach label
	too little contrast of teach label and storage box	a) Clean teach label and storage box
	teach label out of search area	a) Shift the teach label by altering the coordinates of the search area b) Select <b>Configuration...</b> in the <b>Service</b> menu c) Click twice the component with the left mouse button d) Alter the coordinate(s) e) Restart the teaching
	teach sensor or connection defective	a) Check the connection, if necessary replace the gripper

## 5.3 Integrating a Drive



### Information

If you want integrate a new type of drive in the system, you need

- the software modules for the drive in the rho3
- the teach rule for the drive type



### ATTENTION!

**Configure and teach each drive slot as an individual component. This also applies when several drives are mounted in the same housing.**

- a) Select **Configuration** in the Service menu
- b) Pull one drive into the window **Layout** with the right mouse button pressed
- c) Open the **Configuration** window with a double click on the item. Update only the **Description** and the **Type** (⇐ ARG)
- d) With the left mouse button pressed draw the connections to
  - robot
  - host
- e) If you integrate several drives repeat the procedure b) - d)










### Information










If no drive is yet available, measure the coordinates with the test program as described at **h)**

**If you have a drive taught, do as described at f) .**

- f) Open the Configuration window of a drive taught and note the coordinates of the reference position
- g) Coordinates of the new drive:  
measure the distance from the reference position and recalculate it with 1/100 mm accuracy (observe the right hand rule!). Go on with point i).
- h) Robot test program:
  - Switch the main switch on
  - Press <CONTROL ON>
  - Wait until the reference movements are completed
  - Call up the robot test program: press ALT + SHIFT + <dead man>
  - Press 1 + <dead man> (TEST)
  - Press 2 + <dead man> (Move Axes)

- Press **1** + <dead man> (Move Robot)
- Press **3** + <dead man> (Search Teach-Label)
- Press 
- Move the robot roughly to the position of the left (bottom) teach label by entering the coordinates
- X (0 - 210) 1st axis or press 
- Y (0 - 1200) 2nd axis or press 
- Z (0 - G\_Z\_Maxlimit, depending on 12R,15R or 18R) or press 
- C (0 --> no movement, 1 --> position 0°, 2 --> position 90°, 3 --> position 180°, 4 --> position 270°)
- After entering  keep the <dead man> button pressed until the movement stops. (0 generally means no change of position for the respective axis).
- Press 
- Move the robot to the teach label (position the centre of the yoke onto the label, distance 0.5 to 5 cm) by moving the axes 1 - 3 with the buttons
- **1+** , **1-** + <dead man>
- **2+** , **2-** + <dead man>
- **3+** , **3-** + <dead man>
- When label position reached, press **0** for cancel moving
- Start the search by pressing  .
- After measurement the results are displayed by the PHG.  
Teacherror! means that the teach label has not been recognized.  
Causes are either the incorrect distance between gripper and teach label, or the teach label is not within the search area
- Read off the coordinates
- Enter the coordinates into the Graphical configuration of the AMU
- Repeat the procedure if you integrate several drives
- Save the configuration
- Close the test program

- i) Open the **Configuration** window of the new drive.
  - Enter the coordinates measured
  - Select the **Arrangement**
- j) Save the configuration: click on **Save** and close the window
- k) Open the **LOG Control Center**
- l) Select **Archive ... Update Device** in the **Service** menu and wait for the message The database AML was updated in the **LOG Control Center**.
- m) Execute **Shutdown AML...**
- n) Restart the AMU with startup at the appearing OS/2 window
- o) In the file "KONFIG.DAT" position 59 - 62 check the drive type (☞ page 12 - 5) and change it with the EPM editor if necessary
- p) If you have changed the "KONFIG.DAT" transfer it with the **Rho File Manager**
- q) Restore the "KONFIG.DAT" to the rho control:
  - Press **ALT** + **SHIFT** + <dead man>.
  - Press **2** + <dead man> (Read).
  - Press **0** + <dead man> (Exit).
- r) Reduce the processing speed to 10% (PHG Mode 11.4).
  - Press **MODE** (# appears on PHG display)
  - Press **1** , **1** (11), press **↩** (help functions)
  - Press **MODE** (# appears on PHG display)
  - Press **4** , press **↩** (adjust VFACTOR)
  - Press **0** , **.** , **1** (0.1), press **↩**
- s) Teach the new drive with the option **1N (Teach...singlecommand)**
- t) Reteach the new drive with the option **1**
- u) Test the AMU commands **Put** and **Get** (or **Mont** and **Keep**) on all new drives - keep track of possible archive changes
- v) Check whether the gripper moves into and out of the drive slot smoothly (does not bump into the edges of the slot).
- w) Adjust the normal processing speed (100 %).  
(if menu VFACTOR already present, do only the last order)

- Press  (# appears on PHG display)
  - Press ,  (11), press  (help functions)
  - Press  (# appears on PHG display)
  - Press , press  (adjust VFACTOR)
  - Press , press  . (100 %)
- x) Save changed data on diskette 3 “AMU Update“(online possible)
- C:\AMU\AMUCONF.INI
  - C:\AMU\KRNREFPT.R01
- y) Save “KONFIG.DAT” with the **Rho File Manager**



# 6 Robot and Tower Test Program

---

The test program contains all test functions for the:

- handling unit
- storage towers



### Information

**When you enter numeric values a meaningless numeric value may be displayed. It is not active anymore, however.**

Preconditions for the test program:

- Robot or storage tower has completed the reference movements.
- Files required in the rho control system
  - INIT.IRD
  - KONFIG.DAT
  - TKONFIG8.DAT
  - ETEST.IRD
  - ETEST.DAT
  - QTURM.IRD (only on systems with Quadro towers)
  - HTURM.IRD (only on systems with Hexa towers)
  - ETEACH.IRD
- Parameterize the file “KONFIG.DAT”:
  - G\_Z\_MAXLIMIT- height of handling unit (small, medium, high)
  - G\_Y\_CAMERA
  - G\_Z\_CAMERA
- Parameterize the storage towers in the file “TKONFIG8.DAT”:
  - G\_Adr\_QT1 , G\_Adr\_QT2 - for Quadro towers
  - G\_Adr\_HT1 ... G\_Adr\_HT4 - for Hexa towers

## 6.1 Starting the Program

---

The start procedure depends on the value PHG-Echo.

The individual PHG-Echo modes (0 - 3) mean the following:

- 0: no PHG display, operation with AMU
- 1: with PHG display, operation with AMU

- 2: with PHG display, stand-alone operation without AMU
- 3: with PHG display, stand-alone operation without AMU and without gripper



### Information

You can read back all DAT files with the command “READ” .

### PHG-Echo 0 or 1

Start the program:

- from the running production program by pressing **ALT** + **SHIFT** + <dead man>
- from the main menu by pressing **1** (TEST)

```
AML/E TEST V0230

3 = INFO      2 = READ
1 = TEST      0 = EXIT
```

When you have started the program the following main menu appears.

```
1 Installation
2 Move Axis
3 Continous runs
9 END
```

No further commands of AMU are executed.

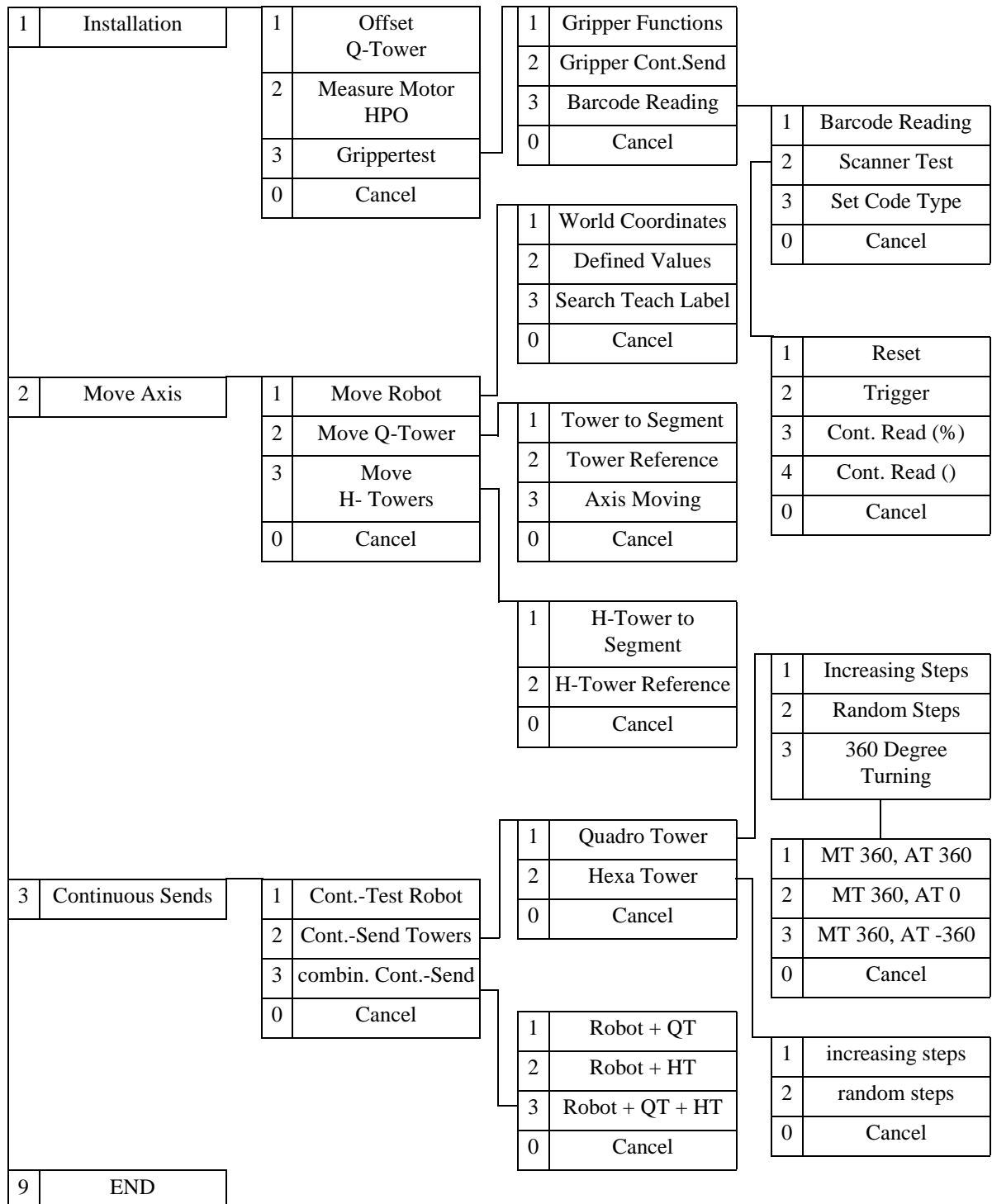
### PHG-Echo 2 or 3

The program starts automatically, when the system has completed its reference movement.



## 6.2 Menu Tree

Select the menus by pressing the respective key (e. g. **1**) + <dead man>.



## 1 Installation

### 1.1 Offset Quadro Tower

#### Preconditions

- gripper works
- Quadro tower is in reference position
- the main menu of the test program has been called up

1	Installation
2	Move Axis
3	Continuous Sends
9	END

- no accessories required

#### Procedure


- Press **1** + <dead man> (installation).
- Press **1** + <dead man> (offset Quadro tower).
  - The Quadro tower turns to segment 7 (as it turns an asterisk appears on the PHG display).
- Move the handling unit roughly to the bottom left teach label (⇨ page 5 - 15).
  - The PHG display indicates the coordinates in the sequence X-, Y-, Z- and C-axis and prompts you to enter a new position.
  - Enter a new rough position for the handling unit.

By pressing **↔** or **0** the position is not changed.

Values below 210 mm for the X-axis will not be accepted.


- Enter the angular position of the C- axis not in degrees but as a numeric value (count direction is clockwise: 0° = 1, 90° = 2, 180° = 3, 270° = 4).
- You can interrupt the procedure to reaccess the rough position by pressing **0** + <dead man>.
  - Press <dead man> during the movement. When you let it go the movement stops immediately.

Then quit the procedure by pressing **0** .

- f) Precisely position the handling unit on the bottom left teach label (compartment 1).
  - The bracket of the gripper must be centered on the teach label. The distance to the teach label can be very low.
  - Move the gripper from the rough position onto the teach label by pressing  
  
<dead man> + axis direction buttons ( **1+** , **1-** etc.).
  - Adjust the speed of motion with <dead man> + **1** .
- g) Start the search for the label by pressing **0** .
  - The distance between gripper and teach label and the point of gravity of the teach label are measured.
  - The Quadro tower is now automatically measured. When the distances to the tower have been measured (left and right teach point), these will be displayed to allow to monitor the tendency in the correction of the segment positions. The program runs in cycles until the measurements show that no further corrections are required.
  - To continue the program press  .
- h) Measuring the auxiliary tower segment.
  - When the main tower offset has been measured successfully the tower automatically turns to the auxiliary tower segment 1. The procedure previously used for measurement of the main tower offset now begins for the auxiliary tower.
- i) Saving the values in “tkonfig8.dat”.
  - The system prompts you to decide whether or not to save the measured values.  
  
Quit by pressing **0** .
- j) Finally the Quadro tower makes reference movements with the new offset values in “tkonfig8.dat”.

The menu item is designed for check-up only.

## 1.2 measure Motor HPO

- Finds the offset between the reference point switch and the zero mark of the motor measuring system after mechanical changes on the drive (e. g. replacement of motor or drive belt)
  - all axes move to position “0”
  - select axis with 
  - enter parameter P 207 and home position offset (HPO) for the axis
  - the parameter values are displayed on the PHG display
  - transfer the parameters to the control unit or the drive amplifier.

Insert only the new HPO-values in the amplifier.

## 1.3 Grippertest

### 1.3.1 Gripper-Functions


Test of the following gripper functions:



- close/open gripper
- yoke forward/backward
- gripper vertical/horizontal
- gripper 0°/7°
- CRASH sensor (CRASH; actuate manually)
- “Cassette present” sensor (CASS\_DA sensor; actuate manually)

Procedure:

#### Information



Proceed to the next test by pressing .

- Press  at the end of the test when the PHG just doesn't display anything.
- Don't press  too long, otherwise a test will be skipped!

You can quit a test by pressing .

- The end positions are displayed as **reached** or **not reached** (exceptions: gripper vertical/horizontal and gripper 0°/7°).
- If there is no agreement, check the wiring.
- Actuate the sensors CRASH and CASS\_DA manually. After the response time of the program of approx. 2 s the status of the sensor is displayed.

### 1.3.2 Gripper -Cont.Send

Continuous test of the gripper. The tests run in cycles.

Quit by pressing  + <dead man>.

If a position is not reached the continuous send stops.

The gripper test resumes when you press .


### 1.3.3 Barcode-Reading

#### 1.3.3.1 Barcode Reading

To optimize the barcode reading position proceed as follows.


- Set all correction values for the barcode reading positions in “KONFIG.DAT” to “0”. The robot control program must adopt these values (read KONFIG.DAT).
- Then send a Look command to AMU. (dont use a comartment 1st row and select the most difficult barcode)
- Start the test program and call up menu item “Barcode reading”.  
(1 Installation, 3 grippertest, 3 barcode reading)

Meassuring of the  
Offset for  
Barcode-Reading.  
More with Enter

Input: 


BC=\*NOREAD                      0%  
1 Correction  
0 Cancel  
More with Enter

Display of the actual read qualityt  
(best value = 100%)

Correction (1) only, if the label not  
in the scann area. (function   
move robot)

Canel (0) if optimization not neces-  
sary (read-quality >90%)

Optimimization:

Input: 

Measuring of the  
X Offset for  
Barcode-Reading.  
More with Enter

Measuring of the  
Y Offset for  
Barcode-Reading.  
More with Enter


X:213.490Y:1170.46  
Z:516.070C:180.000  
BC=0008115 90%  
BESTLEVEL=100%


Measuring of the  
Z Offset for  
Barcode-Reading.  
More with Enter

X:213.490Y:1170.46  
Z:516.070C:180.000  
BC=000815 90%  
BESTLEVEL=100%

Measurement distance

Rack - Robot

Input: 


Input: 

Robot moved in small steps in the  
Y-axis, for looking the area with  
the best read quality



### Information

**Looking works in  
positive direction  
until the sanner find a  
label (eventualy on  
the next compart-  
ment)**

Input: 

Robot moved in small steps in the  
Z-axis until the scanner dont read  
the barcode.

On the end , the scanner read the  
label on the optimized position

```
Barcodereadoffset
X:100    Y:230
Z:300    Level: 100
More with Enter
```

The values for x,y and z will be displayed in 1/100mm and should be write in KONFIG.DAT



### Information

**Dont use the value for the Y-axis on the I/O-unit. Found this value with try and error:**


**The media turned 180° should be not readable**

- Activate the new values with the READ-command in the robot test program
- Cancel the test program
- Save the new KONFIG.DAT on diskette „Robot&Tower Software“.

### 1.3.3.2 scanner test

Function to looking for problems with scanner or communication to the scanner.  
Start a **Look** command, befor you use this function)

```
SCANNERTEST
BC=
Level    =      %
More with ENTER
```

input: 

```
1 Reset 2 Trigger
3 Continous Read(%)
4 Continous Read( )
0 Cancel
```

Select a function.

#### 1.3.3.2.1 Reset

- Use:  
For problems with communication
- Function:  
Der Scanner will be startup the internal program, without delete scanner parameters from EEPROM (Codetypes) . Feedback of the scanner will be displayed on PHG.

#### 1.3.3.2.2 Trigger

- Use:  
Test the Scanner with a single read in a Test mode
- Function:  
The control send to the scanner a command for read a barcode. The code will be read 50 times und converted.The result barcode and read quality will displayed on PHG.



### 1.3.3.2.3 Continous Read (%)

- Use:  
Test of the Scanner for longer time in the test mode
- Function:  
The control send continous commands for read barcode to the scanner with the option of stastic check. After cancel of the the contious send with

0 the read quality will displayed on the PHG.

```
. run
BC =
Level    =      %
0 cancel
```

```
. run
BC =
total level =      %
0 cancel
```

Read barcode in continuous run with 1 .

- evaluation of 50 scans each
- display of the respective attempt and the reading level (Level)
- when the continuous run is quit the percentage of the reading level is output in relation to the attempts (level sum)

Quit the continuous run with 0 .

### 1.3.3.2.4 Continous Read()

```
. run
BC =
0 cancel
```

Simulation of real operation with 2 .

- comparison of barcodes read and the first value read, quit upon deviation
- display of the barcode and the attempts

Quit the continuous run with 0 .

### 1.3.3.3 set Codetype

- Use:  
For set up scanners for other codetypes as codelength then code 39, STK code with 6 digit
- Codetypes:
  - Code 39
  - Code 128
  - STK-Barcode
  - Interleaf 2 of 5
  - CODABAR
  - UPC
  - EAN

CODETYPE :  
Code enable?  
  
ENTER=Yes / 0=No

Input  if settings should be changed,

no change of settings

Fixed Codelength ?  
  
ENTER=Yes / 0=No

Input  if used in the archive  
only 6-digit Volser

Input  if used in the archive  
variable length of the volser (until 16 digits)

Reading Code

Parameter will be write in the scanner

CODETYPE :  
BC=  
ENABLE?  
ENTER=Yes / 0=No


Code-Type settings will be saved in Scanner EEPROM .

Command confirmed with beep.

## 2 Move Axis

### 2.1 Move Robot

#### 2.1.1 World-Coordinates

Enter the speed (1 - 250 mm/s) and confirm by pressing .











#### ATTENTION!

#### Collision hazard!

**position axes 1+2 before moving axis 3.**

- **Axis 1: position <5**
- **Axis 2: position between 280 and 920**

Move the axes

- Axis 1 (X):  ,  + <dead man>
- Axis 2 (Y):  ,  + <dead man>
- Axis 3 (Z):  ,  + <dead man>
- Axis 4 (C):  ,  + <dead man>

Alter the speed by pressing  + <dead man>.

#### 2.1.2 defined Values

The position is not changed by pressing  or .

Enter the end positions for the movements in the following sequence:

- axis 1 (X)
- axis 2 (Y)
- axis 3 (Z)
- axis 4 (C): enter the position of the C-axis not in degrees but as a numeric value (count direction clockwise: 0° = 1, 90° = 2, 180° = 3, 270° = 4)



Keep the <dead man> button pressed during the movement.

The movement stops immediately when you let it go.

### 2.1.3 Search Teach-Label

Search teach label (“manual teaching” in three stages for all components)

- Roughly move to the position of the left teach label.

With  or  will not change the actual position

- Move precisely to the label by adjusting the centre of the gripper yoke to the teach label.
- Start the search process.
  - The measured positions of the teach label are displayed. These can be adopted directly into the AMU configuration.
- Possible problem: the gripper is not positioned with sufficient precision on the teach label.
- Causes:
  - the gripper is too far away from the object
  - the search function does not find the teach label
- Solution: measure the object once more.

### 2.2 Move Q-Tower

#### 2.2.1 Tower of Segment

Turns the Quadro tower to a preset segment between 1 and 32

Quit the function by pressing  or .

#### 2.2.2 Tower Reference

References the Quadro towers.

Answer the prompt “Quadro tower to be referenced” by pressing .

Quit the function by pressing .

#### 2.2.3 Axis Moving

Moves the main or auxiliary tower.

- main tower:  ,  + <dead man>
- auxiliary tower:  ,  + <dead man>

Quit the function by pressing .

## 2.3 Moving H-Towers



### Information

For the following functions you must first select the Hexa tower.

The number of the Hexa tower is not the same as the value stored in “TKONFIG8.DAT”, but corresponds to the physical sequence (connection to the rho control system). If no Hexa tower is configured in “TKONFIG8.DAT” the test is interrupted.

### 2.3.1 H-Tower to Segment

Turns the Hexa tower to a preset segment between 1 and 6.

Quit the function by pressing  or .

### 2.3.2 H-Tower reference

References the Hexa tower.

Quit the function by pressing .

### 3 Continuous Sends

#### 3.1 Cont.-Test Robot

The handling unit moves to its initial position.

Enter the maximum value for the Z-axis (depending on the height of 12, 15 or 18 rows). The value entered is compared to the value G\_Z\_MAXLIMIT stored in "KONFIG.DAT". Ex works this value is adjusted to a 12 row handling unit.

Enter the speed (0.1 to 1).

Quit the function by pressing  + <dead man>.

When you quit the function the handling unit returns to its initial position.

#### 3.2 Cont.-Send Towers

##### 3.2.1 Quadrotower

The continuous send starts only when a Quadro tower has been configured.

##### 3.2.1.1 Increasing Steps

Accesses all segments in increasing steps.

Enter the speed in percent (0.1 to 100).

Quit the function by pressing  + <dead man>.

##### 3.2.1.2 Random Steps

Accesses all segments in random steps.

Enter the speed in percent (0.1 to 100).

Quit the function by pressing  + <dead man>.

##### 3.2.1.3 360 Degree Turning

Choice of three variations:

- 1 MT 360, AT 360
- 2 MT 360, AT 0
- 3 MT 360, AT -360

Enter the speed in percent (0.1 to 100).

Quit the function by pressing  + <dead man>.

### 3.2.2 Hexa Towers

The continuous send starts only when a Hexa tower has been configured.



#### Information

**For the following functions you must first select the Hexa tower.**

**The number of the Hexa tower is not the same as the value stored in “tkonfig8.dat”, but corresponds to the physical sequence (connection to the rho control system). If no Hexa tower is configured in “tkonfig8.dat” the test is interrupted.**

**Turn all configured Hexa towers by pressing .**

#### 3.2.2.1 increasing steps

Accesses all segments in increasing steps.

Enter the speed in percent (0.1 to 100).

Quit the function by pressing  + <dead man>.

#### 3.2.2.2 random steps

Accesses all segments in random steps.

Enter the speed in percent (0.1 to 100).

Quit the function by pressing  + <dead man>.

### 3.3 combin. Cont.-Send



#### Information

**A combination of continuous sends is possible only with PHG-Echo 2 or 3.**



### 3.3.1 Robot + QT

Combines continuous send of handling unit and Quadro tower.

### 3.3.2 Robot + HT

Combines continuous send of handling unit and Hexa tower.

### 3.3.3 Robot + QT + HT

Combines continuous send of handling unit, Quadro tower and Hexa tower.

## 6.2.1 Quit Test Program

---

1	start Values
2	safed values
3	Testprogram
0	EXIT

When quitting the test program choose either secure values or start values to avoid collisions.

start values: position at start of test program

safed values: position with saved X and Y axis



# 7 Help Procedures

---
















## 7.1 Rho 3 Operating System

---

### 7.1.1 Edit file „KONFIG.DAT“ with PHG

---

Precondition: PHG in operating system - not in test program



- a) One after the other press , ,  (program BAPS/PIC)
- b) One after the other press , ,  (program BAPS-program)
- c) One after the other press , ,  (edit)
- d) Select “KONFIG.DAT” with  or  and confirm by pressing 
- e) To select the line
  - either scroll with the cursor buttons
  - or press , press  and enter the line number, press 






#### ATTENTION!

If you keep  pressed too long the entire line will be erased!

If that happens quit the file without saving the changes:

press , press .

- f) Change the parameters (only possible in insert mode):
  - Place the cursor on the right of the value to be changed
  - Erase the value with 
  - Enter the new value
- g) Save the file: press , press 

- h) Update the file “KONFIG.DAT” in the main memory.  
Choose one of the following possibilities:
  - only in “Auto” operating mode: start the test program and select the command “READ” - then quit the test program
  - reset the control: press the reset button on power supply PS75
- i) Save “KONFIG.DAT” with the Rho File Manager (⇐ ARG).

### 7.1.2 Preparation for manual mode

---





- a) Shutdown AML
- b) Set the rho control to set-up:  
apply with jumper 24 V to input 0.0
- c) Switch the main switch on and let the rho control unit boot
- d) Press <CONTROL ON>
- e) Wait for display:

```
***manual***  
TO03G      23.06.1993  
no reference points!  
(c) 1991 BOSCH
```

### 7.1.3 Manually Moving the Axes (Handling Unit/Quadro Tower)

---

In the PHG operating system:

- a) One after the other press  ,  ,  (Move Axis)
- b) Press  +<dead man> ((5) in explanation of the display panel) (⇐ page 7 - 3)



#### **ATTENTION!**

**Risk of collisions!**

**Before moving axis 4 position axes 1 and 2.**

Explanation of the Display Panel



Information

You cannot see the display until the coordinate system has been selected.

- Increment: (press jog keys just briefly)  
minimum traversing unit for jog mode
- Cont. L.: continous slow traversing
- Cont. S.: continous rapid traversing

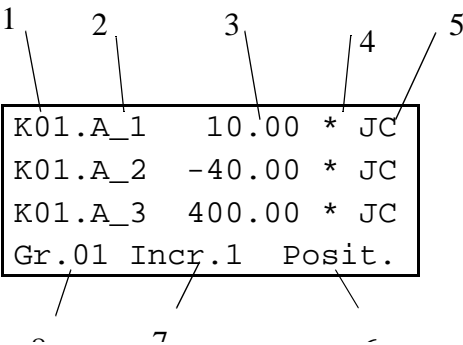





Fig. 7-1: Display panel

Field	Description
1	Kinematic name
2	Axis name (selection with  )
3	Value (mm or °) (refers to the fields 2, 5 and 6)
4	Status position servo loop <ul style="list-style-type: none"><li>• no display: axis position not corrected</li><li>• *: axis is within the defined position range</li></ul>
5	Active coordinate system <ul style="list-style-type: none"><li>• JC: joint coordinates (machine coordinates)</li><li>• WC: world coordinates (room coordinates)</li><li>• GC: gripper coordinates</li></ul>
6	Signification of the values (refers to field 3) <ul style="list-style-type: none"><li>• Posit.: axis position</li><li>• Lag.: difference between actual and target coordinate</li><li>• Offset: not in use</li></ul>
7	Traversing mode (selection with  )
8	Group (always Gr . 01)

### Axis movement:

- axis 1 (X): **1+** , **1-** +<dead man>
- axis 2 (Y): **2+** , **2-** +<dead man>
- axis 3 (Z): **3+** , **3-** +<dead man>
- axis 4 (C): **4+** , **4-** +<dead man>

### Quadro Tower

Press **KIN** +<dead man> , 

Press **COORD** +<dead man> ((5) in explanation of the display panel)

Move the axes of the Quadro tower:

- main tower 1 : **5+** , **5-** +<dead man>
- auxiliary tower 1 : **6+** , **6-** +<dead man>
- main tower 2: **A** , **B** +<dead man>
- auxiliary tower 2: **E** , **F** +<dead man>

### Completing the Axes Test

- Shutdown AML
- Remove the jumper 24 V from input 0.0
- Switch the main switch on
- Let the rho control unit boot
- Press <CONTROL ON>
- The AML/E system does its reference movements

### 7.2 Adjustment of AMU interface

---

The protocol 3964R needs a defined timing of its communication partners. If the AMU reaction time is too long, the communication AMU - rho will be cut off.

To minimize this problem, you can increase the timeout values with the following procedure.



#### **ATTENTION!** **Destruction of robot!**

**Wrong input of interface parameters can cause total destruction of the robot. There is no control of data input. Enter the parameters very carefully.**



#### **Information**

**The interface parameters are not part of the machine parameters. They are saved on the EEPROM of board CP/MEM.**

#### **When do you have to adjust the AMU interface?**

- After the installation of a new system
- After an backup of the EEPROM on board CP/MEM
- After the changing of board CP/MEM

#### **How to adjust the AMU interface**

- a) Stop the robot with the host commands HOLD and ROSO
- b) Press the <EMERGENCY STOP> button
- c) Determine the version of the operating system. Press step by step
  - Mode 8 Enter (Diagnosis)
  - Mode 11 Enter (Version)
  - Read the operating system version from the PHG (TO03G or TO05L)
  - Press Shift 1 (Cancel version)
- d) Choose Edit Machine Parameters. Press step by step
  - Mode 8 Enter (Machine parameters)
  - Mode 2 Enter (Edit machine parameters)
  - -00000 Enter (Input password)
  - Enter (Accept parameter set name)
  - Enter

**Procedure for operating system version T003G**

a) Check the VAA. Press step by step

- === Enter (address input)      display    address=
- 005180 Enter (address)      display    address=005180:
- NCKD Enter      display    18DCC
- Enter

**Information**

**If the initialization flag has value 1, there is no reset of communication parameters during startup.**

b) Set the initialization flag. Press step by step

- === Enter (address input)      display    address=
- 018DCC Enter (address)      display    address=018DCC:
- NCKB Enter      display    0
- 1 Enter

c) Set the repeat delay time. Press step by step

- === Enter (address input)      display    address=
- 018DCE Enter (address)      display    address=018DCE:
- NCKD Enter      display    FA0 (old value 4000 ms)
- 001F40 Enter (new value 8000 ms)

d) Set the acknowledge delay time. Press step by step

- === Enter (address input)      display    address=
- 018DD2 Enter (address)      display    address=018DD2:
- NCKD Enter      display    226 (old value 550 ms)
- 003A98 Enter (new value 15000 ms)

e) Set the symbol delay time. Press step by step

- === Enter (address input)      display    address=
- 018DDA Enter (address)      display    address=018DDA:
- NCKD Enter      display    DC (old value 220 ms)
- 003A98 Enter (new value 15000 ms)

f) Copy the changed values to the EEPROM. Press step by step

- Shift and 1
- Shift and 1

g) Release the <EMERGENCY STOP> button

h) Start the system



### Procedure for operating system version T005L

- a) Check the VAA. Press step by step
- === Enter (address input)      display   address=
  - 005190 Enter (address)      display   address=005190:
  - NCKD Enter      display   18330
  - Enter



#### Information

**If the initialization flag has value 1, there is no reset of communication parameters during startup.**

- b) Set the initialization flag. Press step by step
- === Enter (address input)      display   address=
  - 018330 Enter (address)      display   address=018330:
  - NCKB Enter      display   0
  - 1 Enter
- c) Set the repeat delay time. Press step by step
- === Enter (address input)      display   address=
  - 018332 Enter (address)      display   address=018332:
  - NCKD Enter      display   FA0 (old value 4000 ms)
  - 001F40 Enter (new value 8000 ms)
- d) Set the acknowledge delay time. Press step by step
- === Enter (address input)      display   address=
  - 018336 Enter (address)      display   address=018336:
  - NCKD Enter      display   7D0 (old value 2000 ms)
  - 003A98 Enter (new value 15000 ms)
- e) Set the symbol delay time. Press step by step
- === Enter (address input)      display   address=
  - 01833E Enter (address)      display   address=01833E:
  - NCKD Enter      display   DC (old value 220 ms)
  - 003A98 Enter (new value 15000 ms)
- f) Copy the changed values to the EEPROM. Press step by step
- Shift and 1
  - Shift and 1
- g) Confirm saving with 1, ENTER
- h) Release the <EMERGENCY STOP> button
- i) Start the system

**Addresses**

<b>Parameters</b>	<b>General address</b>	<b>Address TO05L</b>	<b>Address TO03G</b>
Version specific address	VAA	018330	018DCC
Repeat delay time	VAA + 02 hex	018332	018DCE
Acknowledge delay time	VAA + 06 hex	018336	018DD2
Buffer delay time	VAA + 0A hex	01833A	018DD6
Symbol delay time	VAA + 0E hex	01833E	018DDA

**Parameters**

<b>Parameter</b>	<b>old value (ms)</b>	<b>old value (hex)</b>	<b>new value (ms)</b>	<b>new value (hex)</b>
Repeat delay time	4000	000FA0	8000	001F40
Acknowledge delay time	550/2000	000226/ 0007D0	15000	003A98
Buffer delay time	400	000190	400	000190
Symbol delay time	220	0000DC	15000	003A98

### 7.2.1 Moving Axis 3 (Z-Axis) with function generator

---

Axis 3 must be moved when

- a motor of the robot must be replaced, because it cannot be moved anymore
- the motor of axis 3 is to be replaced



#### Information

**In this operating mode (function generator operation) the drive amplifier forces the motor to perform a cyclical movement. The path, the acceleration and the time of the movement can be adjusted.**



#### WARNING!

**The EMERGENCY STOP function is not active!**

**Shutdown is possible only with the main switch!**


- Apply power to the power supply 160 by manual operation of the contactor K2 (“CONTROL ON”-circuit): apply 24 V on pin 8 (contact 48) of the contactor (the contactor K2 is on the middle level of the device panel)
- Switch on the main switch
- Connect the installation cable to the interface connector COM 1 or COM 2 (if necessary disconnect another cable)
- Connect the installation cable to the drive amplifier plug X6
- Open the AMU OS/2 window
- Insert the disk “Robot & Tower Software”
- Change to drive “A:\” (a:)
- Change to directory “A:\MOOG” (cd moog)
- Call up the communication program “boschtrm” (boschtrm)
- Enter <C> for configurate
- Adjust the configuration
  - Communication Mode RS 232 <1>
  - Communication Port COM1 <1>
  - COM2 <2>
  - Interface type IQ140/RHO3 CAN <2>
  - Helpfile IQ 140/RHO <2>
- Press <ENTER> until the following message appears:

---

Enter first  
letter of a  
command or H  
for help >

input: <SHIFT>+<\*>

Privileged Mode (Y/N) >>	input: <Y>
Password ?	input: <7>, <8>, <2>, <3>
OK!	
Enter first letter of a command or H for help >	input: <O>
Enter second letter >>	input: <R>
Sure (Y/N)?	input: <Y>
Options: 1 CAN Reference 2 Analog Ref 3 Functions Gen ? (1/2/3) >>	input: <3>
- Traverse 1.000 E 1 (revs) ?	= 8,8 cm path from the start position; positive = up input: <1>, <0>
- Tuning Acc. 1.000 EZ [rad/s <sup>2</sup> ] ?	input: <ENTER>
- Tuning Max Speed ? [RPM]	input: <5>, <0>
- Tuning Frequenz Hz 1.000 E-1 ?	input: <ENTER>
Funktion Generator Initialisation	
Enter second letter >>	input: second letter of the command (☞ table)

Command	Input	Result
Start cyclical movement from the start point	<M>, <I>	The brake is released and the axis moves back and forth.
Stop movement	<M>, <O>	The axis stops in the current position and the brake locks.
Release/lock brake	<M>, <B>	<p>Brake is On or OFF Release Brake ( Y/N ) ?</p> <div>  <p><b>WARNING!</b></p> <p><b>When you release the brake the robot slides down!</b></p> <p><b>Support the robot before releasing the brake.</b></p> </div> <p>input:</p> <ul style="list-style-type: none"> <li>• &lt;Y&gt; releases the brake</li> <li>• &lt;N&gt; locks the brake</li> </ul>

m) Unplug the installation cable (replug other cable)

- AMU interface
- drive amplifier socket X6

n) Remove the disk "Robot & Tower Software"

o) Switch off the main switch



### Information

You can also release the brake, by applying 24 V directly to "Logic" and "brake off". The 24 V required are available at the power supply 160 when the main switch is on.

### 7.3 Software-Backup of the AML/E System

---

After each alteration of the AML/E system a software backup is required.

An overview of the backups required is shown on the next page.



#### **Information**

**Copy the altered files of**

- **the AMU with the OS/2 command “copy“**
- **the AMU database with the Database Manager**
- **the CP/MEM board with the Rho File Manager**
- **the drive amplifiers with the program “Boschtrm” or „terminal“**

Alteration	File Altered	Copy File to
Component in the graphical configuration <ul style="list-style-type: none"> <li>• added</li> <li>• altered</li> </ul>	C:\AMU\AMUINI.INI ( <b>Shutdown AML...</b> required)	A:\ (Disk AMU Update)
	C:\AMU\KRNREFPT.R01	
	Board CP/MEM: KONFIG.DAT	A:\SOURCES (Disk Robot & Tower Software)
	AMU database	A:\ (Disk Database-Backup)
Reteaching	C:\AMU\KRNREFPT.R01	A:\ (Disk AMU Update)
Gripper replaced	Board CP/MEM: KONFIG.DAT	A:\SOURCES (Disk Robot & Tower Software)
Storage tower-offset adjusted	Board CP/MEM: TKONFIG8.DAT	
Motor replaced	board CP/MEM: MPRHO3.BIN	
HPO altered	Drive amplifier: EA*B20.PRS (* = number of axis)	A:\MOOG (Disk Robot & Tower Software)
Volser ranges altered	C:\AMU\AMUINI.INI	A:\ (Disk AMU Update)
	AMU database	A:\ (Disk Database Backup)
Host computer connection altered	Configuration files of the Communications Manager (☞ page 7 - 14)	A:\ (Disk AMU Update)
Update of robot- and storage tower software	Board CP/MEM: all files ("Backup" command of the Rho File Manager)	A:\SOURCES (Disk Robot & Tower Software)
AMU-fix	All files of the AMU-fix on the correction disk	A:\UPDATE (Disk 3 AMU Update)

### 7.3.1 Saving the Configuration Files of the Communication Manager



#### Information

Dependent on your communication type you have to save

- the special configuration files to directory C:\CMLIB\
- the files „PROTOCOL.INI“, „SETUP.CMD“ and „STARTUP.CMD“ to the directories shown below

Directory	Filename	Communication Type
C:\CMLIB\	3270.*	EXCP
	LU62S.*	LU 6.2 Single Session
	LU62SC.*	LU 6.2 Single Session with additional Coax
	LU62P.*	LU 6.2 Parallel Session
	LU62PC.*	LU 6.2 Parallel Session with additional Coax
	BOCA.*	only DCAF connection
C:\IBMCOM	PROTOCOL.INI	LAN Adapter and Protocol Support
C:\TCPIP\BIN	SETUP.CMD STARTUP.CMD	TCP/IP

- Change to the OS/2 desktop
- Open an OS/2 window
- Insert disk 3 „AMU Update“
- Copy the files to disk 3
- Remove the disk



## 8 Maintenance

---

### 8.1 For Your Safety

---

According to German accident prevention rules and standards VBG 4, VDE 0105 and VDI 2853 maintenance work must be carried out exclusively by trained personnel.

A precondition is knowledge of the safety rules for work on electrotechnical equipment.



#### **WARNING!**

**During all work observe the safety rules in chapter 3 “For Your Safety” (☞ page 3 - 1).**

### 8.2 Preparing Maintenance Work

---



#### **WARNING!**

**All maintenance work, except functional checks (e. g. shutter) must be carried out only when the system is switched off and voltageless.**

**Shut the AML/E system down before (☞ Operator Guide) and secure it against switch on.**

Attach a warning sign to it (☞ page 3 - 12).



#### **Information**

**Protocol every maintenance job in the system logbook with**

- **date and**
- **next due date for this maintenance job**

**When inserting the 400 g-cartridge at the grease gun additionally air the grease gun.**

### 8.3 Putting Back into Service

---



#### **WARNING!**

Before starting the AML/E system be sure the start will not

- endanger people,
- damage property.

Start the AML/E system (☞ Operator Guide).

### 8.4 Mechanic Maintenance

---

On the following pages the maintenance jobs are listed in tables.

- handling unit part 1-5 (☞ page 8 - 3)
- gripper part 1+2 (☞ page 8 - 8)
- I/O unit B (☞ page 8 - 10)
- Hexa tower (☞ page 8 - 11)
- Quadro tower 1+2 (☞ page 8 - 12)

Approved lubricants (☞ page 12 - 8).

The time in the table is calculated for a system with 1 Quadrotower and 2 Hexatower.

Handling Unit 1

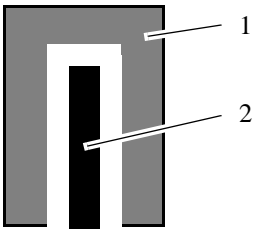


Fig. 8-1: Measuring Bracket

Unit	Location	Job	Fig.	Interval [year]	Time [min]
Toothed drive belt	axes 1-3, transmission axes 1+2	check for <ul style="list-style-type: none"><li>wear (abrasion, damage, excessive play)</li></ul>		0.5	10
	axis 1	check the belt tension (measuring device: Clavis, MULCO) <ul style="list-style-type: none"><li>hold the measuring bracket (1) above the center of the belt (3), but don't touch the belt (Fig. 8-1)</li><li>strike the belt normal to its running direction</li><li>setpoint: <math>f = 98 \pm 5</math> Hz (value confirmed acoustically)</li><li>repeat the measurement on the second belt (2)</li></ul> deviations: re-tension the belt (required: 2 clamping units each VY 668-1 IA3 and VY 668-2 IA3) <ul style="list-style-type: none"><li>move axis 1 to the center position</li><li>mount clamping devices (4) at the ends of the belts</li><li>loosen screw (5)</li><li>tighten belt evenly</li><li>check belt tension (see above)</li><li>tighten screws (5) with torque <math>M = 20</math> Nm</li><li>check the function of the handling unit and re-teach if necessary</li></ul>	8-1, 8-2  8-2  8-3 8-3  8-3	0.5	10

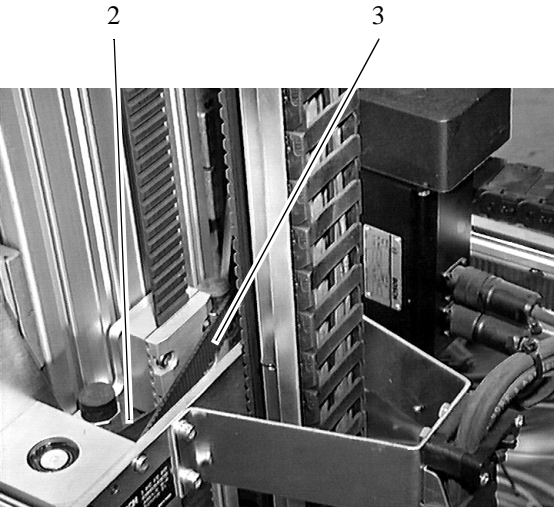


Fig. 8-2: Belt on Axis 1

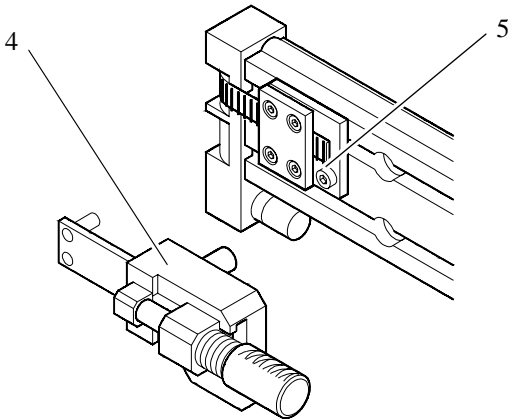


Fig. 8-3: Clamping Device

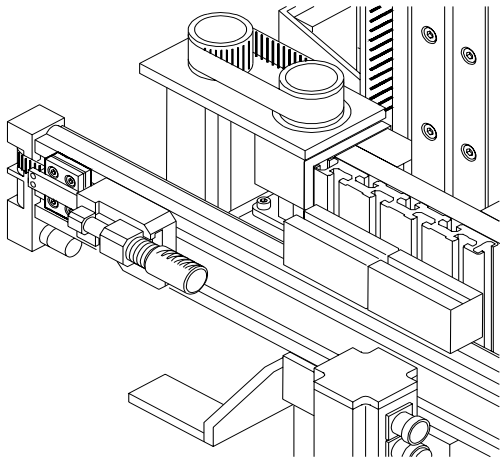


Fig. 8-4: Clamping Unit Mounted

Handling Unit 2

Unit	Location	Job	Fig.	Interval [year]	Time [min]
Cables	entire handling unit	check for <ul style="list-style-type: none"><li>wear (abrasion, damage)</li><li>fastening</li></ul>		0.5	15
Toothed drive belt	axis 2	check belt tension <ul style="list-style-type: none"><li>push the flange plate (3) to the left stop (<math>L = 1170\text{ mm}</math>)</li><li>tension belt at <math>L/2 = 585\text{ mm}</math> with a spring scale (4)</li><li>setpoints: <math>F = 10\text{ N}</math> at <math>X = 18\text{ mm}</math></li></ul> deviation: re-tension belt <ul style="list-style-type: none"><li>dismount the gripper with the flange</li><li>loosen the lock nut (2)</li><li>tension belt with <math>F = 10\text{ N}</math></li><li>adjust dimension <math>X = 18\text{ mm}</math> with screw (1)</li><li>tighten lock nut (2) with torque <math>M = 5\text{ Nm}</math></li><li>mount gripper</li><li>check the function of the handling unit and re-teach if necessary</li></ul>	8-6  8-6  8-5 8-5 8-5	0.5	5

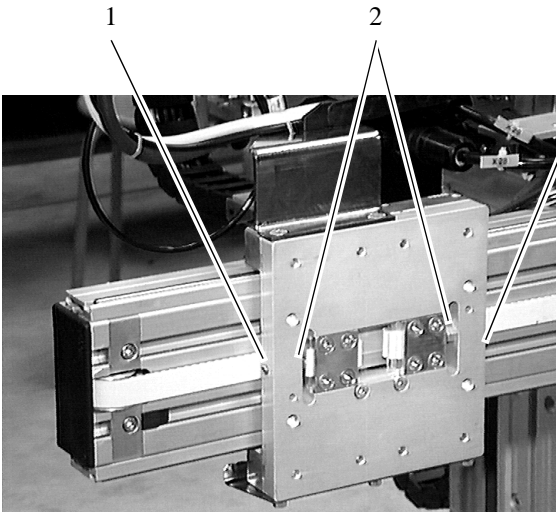


Fig. 8-5: Flange Plate on Axis 2

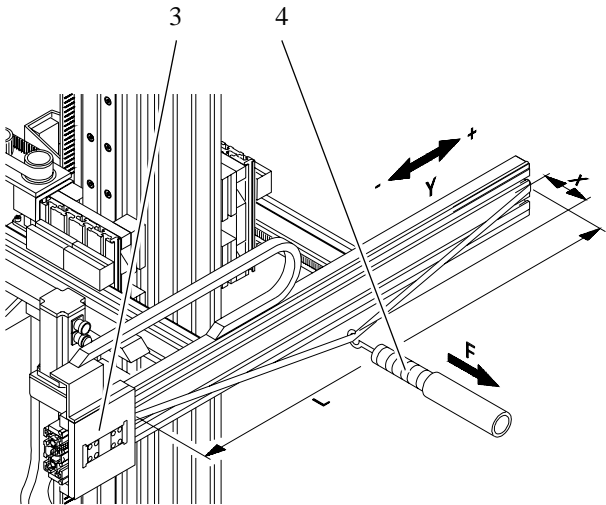


Fig. 8-6: Tension Belt on Axis 2

Handling Unit 3

Unit	Location	Job	Fig.	Interval [year]	Time [min]
Toothed drive belt	axis 3	<p>check belt tension (measuring device: Clavis, MULCO)</p> <ul style="list-style-type: none"><li>• limit the vibrating length to <math>L = 310\text{ mm}</math> (put a block (1) behind the belt and press the belt down)</li><li>• hold the measuring bracket (Fig. 8-1) above the center of the belt (2), but don't touch the belt (→ page 8 - 3)</li><li>• strike the belt normal to its running direction</li><li>• setpoint: <math>f = 120 \pm 10\text{ Hz}</math> (value confirmed acoustically)</li></ul> <p>deviation: re-tension belt</p> <ul style="list-style-type: none"><li>• remove the cover (3) of the deflection pulley</li><li>• wet the threads of the tensioning screws with Loctite</li><li>• evenly tighten the belt with the tensioning screws (4)</li><li>• check the function of the handling unit and re-teach if necessary</li></ul>	<p>8-7</p> <p>8-7</p> <p>8-8</p> <p>8-8</p>	0.5	10

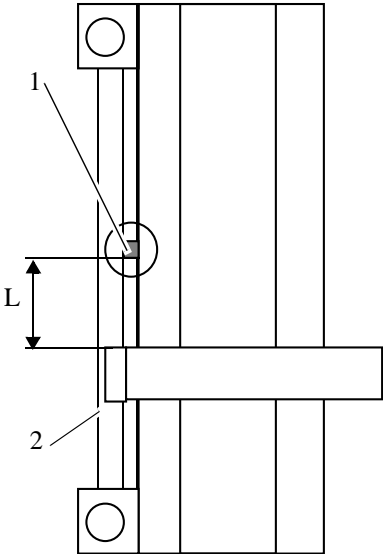


Fig. 8-7: Belt tensioning on Axis 3

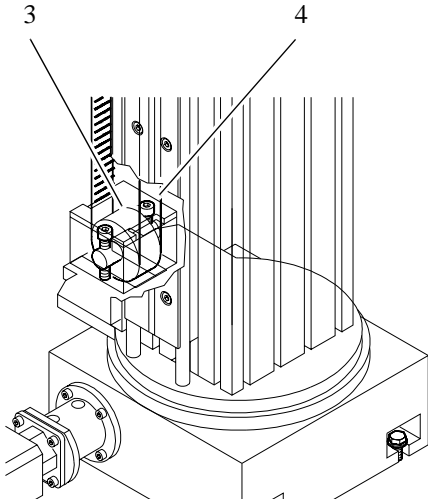


Fig. 8-8: Tensioning Pulley on Axis 3

Handling Unit 4

Unit	Location	Job	Fig.	Interval [year]	Time [min]
Toothed drive belt	transmission axes 1, 2	check belt tension (measuring device: Clavis, MULCO) <ul style="list-style-type: none"><li>• remove cover</li><li>• hold the measuring bracket (Fig. 8-1) above the center of the belt, but don't touch the belt (→ page 8 - 3)</li><li>• strike the belt normal to its running direction</li><li>• setpoint: <math>f = 150 \pm 5</math> Hz (value confirmed acoustically)</li></ul> deviation: re-tension belt (with spring scales) <ul style="list-style-type: none"><li>• loosen or lightly tighten screws (3)</li><li>• be sure the belt is positioned correctly</li><li>• tension the belt by shifting the motor (1)<ul style="list-style-type: none"><li>- pulling force on the motor: <math>F = 380</math> N</li><li>- frequency: <math>f = 150 \pm 5</math> Hz (value confirmed acoustically)</li></ul></li><li>• tighten screws (3) crosswise with torque <math>M = 5</math> Nm</li></ul>	8-9 8-9, 8-10 8-9	1	10
Guide rods	axes 1-3	grease the guide rod (2) on its entire length with a brush (Klüber Topas NCA 52)	8-9	0.5	10

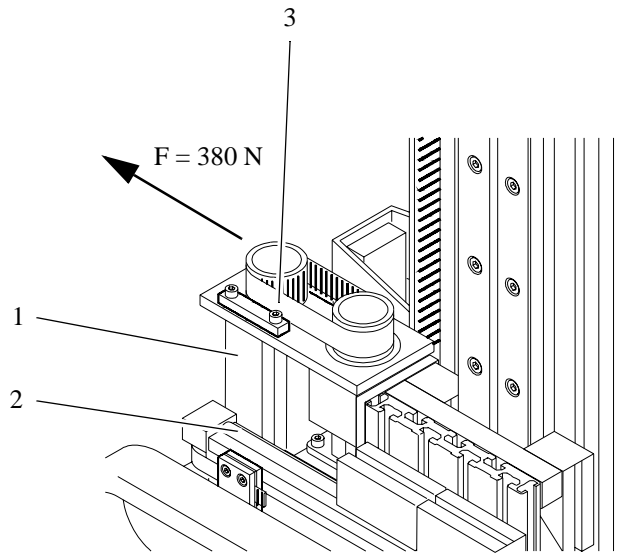


Fig. 8-9: Transmission Axis 1

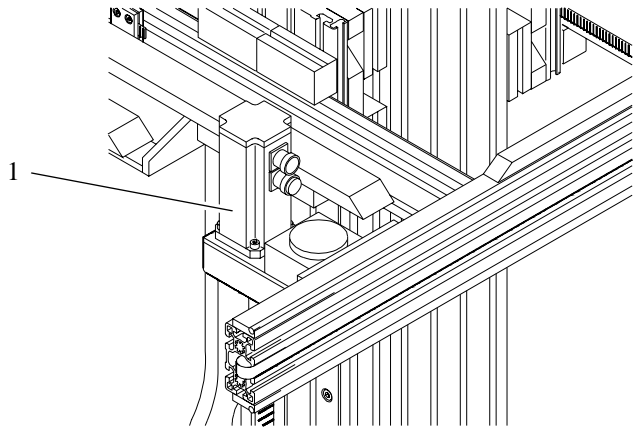


Fig. 8-10: Transmission Axis 2

Handling Unit 5

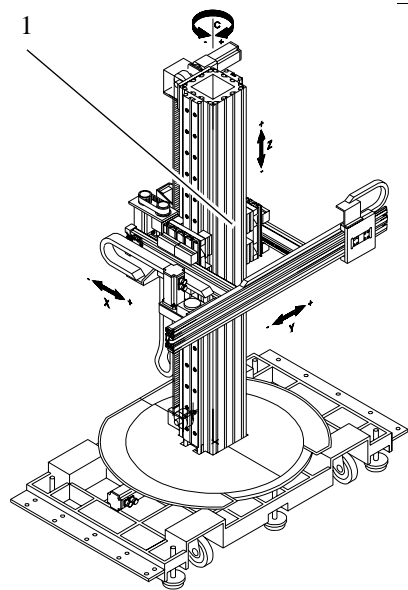


Fig. 8-11: Handling Unit

Unit	Location	Job	Fig.	Interval [year]	Time [min]
Support bearing	axis 1	check play and readjust if necessary <ul style="list-style-type: none"><li>• loosen screws (2) on the upper support bearing</li><li>• at the eccentric (3) adjust bearing to have no play (don't press it tight)</li><li>• tighten screws (2) with torque M = 10 Nm</li></ul>	8-12 8-12 8-12	0.5	10
	axis 2	check play and readjust if necessary <ul style="list-style-type: none"><li>• loosen screws (5) on the upper support bearing</li><li>• at the eccentric (4) adjust bearing to have no play (don't press it tight)</li><li>• tighten screws (5) with torque M = 10 Nm</li></ul>	8-14 8-13 8-14	0.5	
	axis 3	check play and readjust if necessary <ul style="list-style-type: none"><li>• push axis 2 away from the column</li><li>• remove the cover plate (1), the screws are now accessible through the profile's groove</li><li>• proceed as described for axis 1</li><li>• remount the cover plate</li></ul>	8-11	0.5	

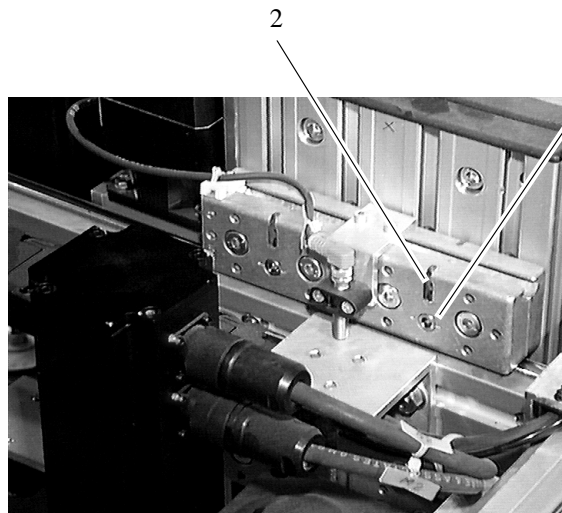


Fig. 8-12: Support Bearing Axis 1

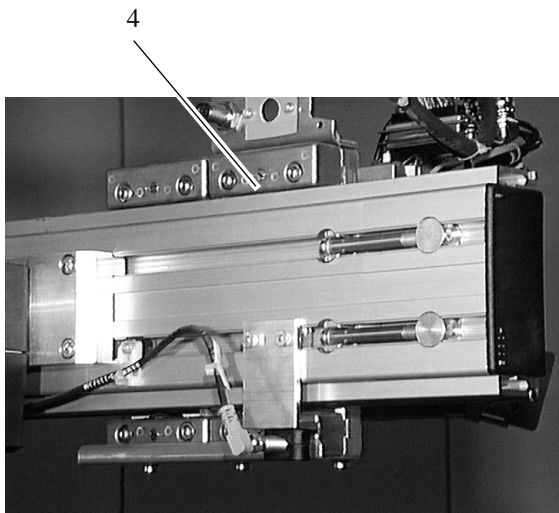


Fig. 8-13: Support Bearing Axis 2

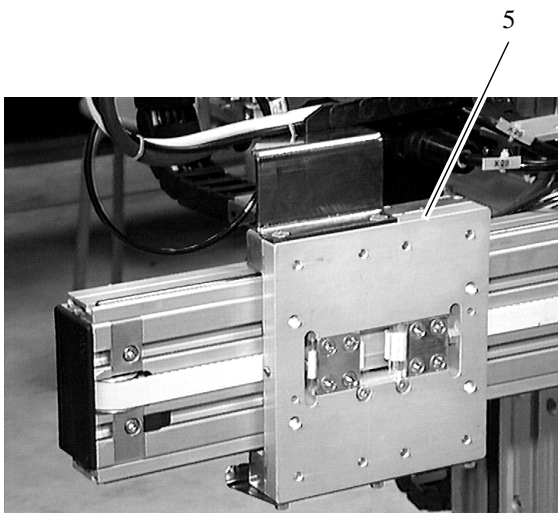


Fig. 8-14: Support Bearing Axis 2

Gripper 1

Unit	Location	Job	Fig.	Interval [year]	Time [min]
Jaws (1)	gripper mechanics	check functions: <ul style="list-style-type: none"><li>• start robot test program</li><li>• start gripper test program (☞ page 6 - 6)</li></ul>	8-15	0.5	10
				0.5	
				0.5	
Pusher (4)	gripper mechanics		8-15	0.5	10
Pusher (4)	gripper mechanics	check for easy movement	8-15	0.5	
Turning mechanics (5)	gripper mechanics	check for easy movement <ul style="list-style-type: none"><li>• shut off compressed air supply</li><li>• turn by 90°</li></ul> Note: when the endposition is reached the force required to turn is a little higher	8-15	0.5	
Scan window (6)	barcode scanner	check for cleanness and clean if necessary	8-15	0.5	

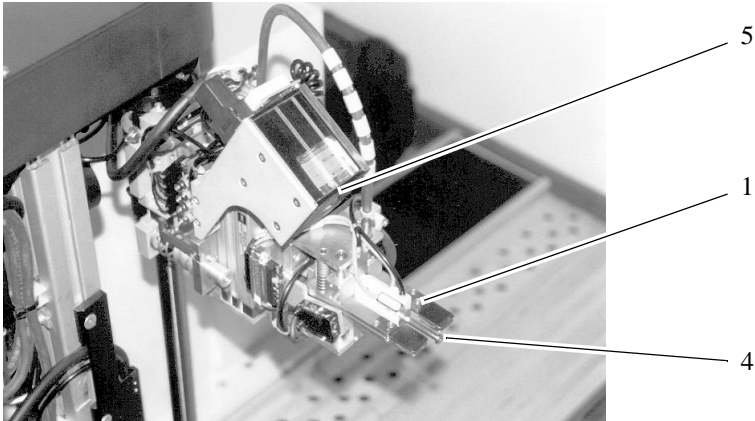


Fig. 8-15: Gripper Mechanics



Mechanic Maintenance

Gripper 2

Unit	Location	Job	Fig.	Interval [year]	Time [min]
Tilting mechanics (1)	gripper	check for easy movement and springyness <ul style="list-style-type: none"><li>• shut off compressed air supply</li><li>• tilt gripper down and let go</li><li>• the gripper must return to its initial position</li></ul>	8-16	0.5	10
Cables of sensors	gripper	check <ul style="list-style-type: none"><li>• wear (abrasion, damage)</li><li>• fastening</li></ul>		0.5	
Air hoses (3)	gripper	check <ul style="list-style-type: none"><li>• wear (abrasion, damage)</li><li>• fastening</li></ul>	8-17	0.5	
Connectors (2)	gripper	check for secure fastening	8-17	0.5	
Maintenance unit with micro-filter (4)	carriage axis 2	drain condensate (manually)	8-18	0.5	

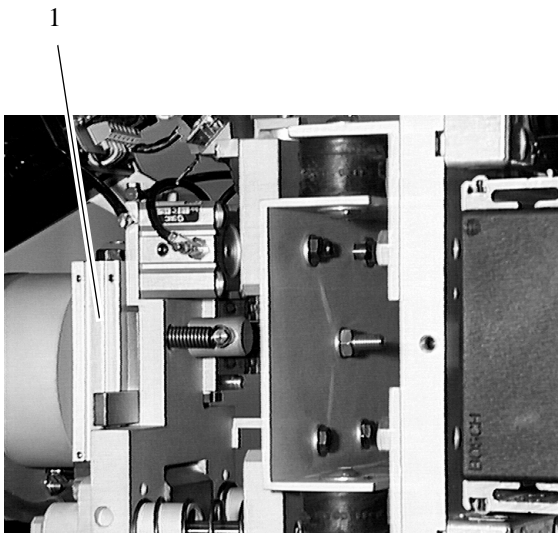


Fig. 8-16: Tilting Mechanics of Gripper

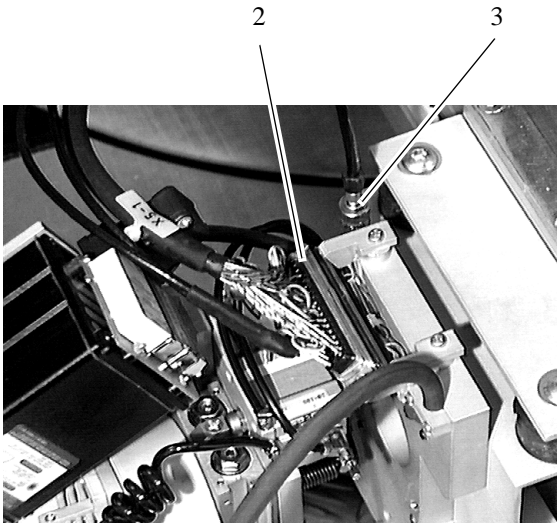


Fig. 8-17: Connections of Gripper

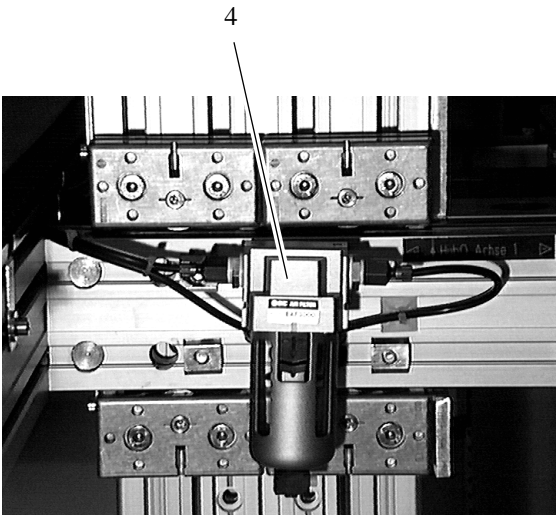


Fig. 8-18: Maintenance Unit on Axis 1

Mechanic Maintenance

I/O Unit B

Unit	Location	Job	Fig.	Interval [year]	Time [min]
Shutter		check the function (close and open)	-	0.5	5
Lightbarrier (1) Problem box	problem box	check the function, if necessary clean opposite reflector • put a medium into the problem box: input 3.3 off • remove the medium: input 3.3 on	8-19	0.5	
Compressed air supply Compressor	bottom compartment • condensate container (2)	drain	8-21	0.5	10
	bottom compartment • pressure contol displays (3)	check pressure adjustment and readjust if necessary • left 5 bar operating pressure • right 6.8 bar accumulator pressure A: area screw- adjustment of the cut-in pressure (turn right both screws = higher shift-point) B: difference screw - adjustment of the cut-off pressure (turn right = bigger difference)	8-21 8-20	0.5	

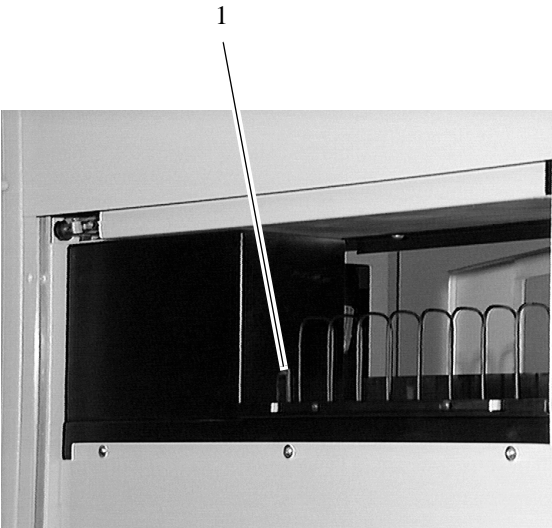


Fig. 8-19: Problem Box Seen from Inside

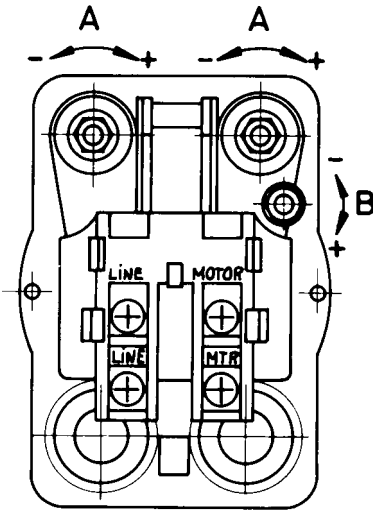


Fig. 8- 20: Compressed air supply

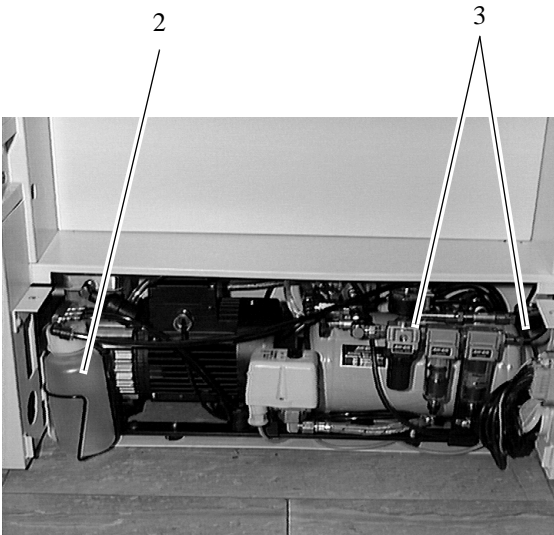


Fig. 8-21: Compressed Air Supply

Mechanic Maintenance

Hexa Tower

Unit	Location	Job	Fig.	Interval [year]	Time [min]
Rotary indexing table	below rotary plate	check for tightness (sight inspection)		0.5	5
Belt of position switch (1)	below rotary plate	check belt tension	8-22	0.5	

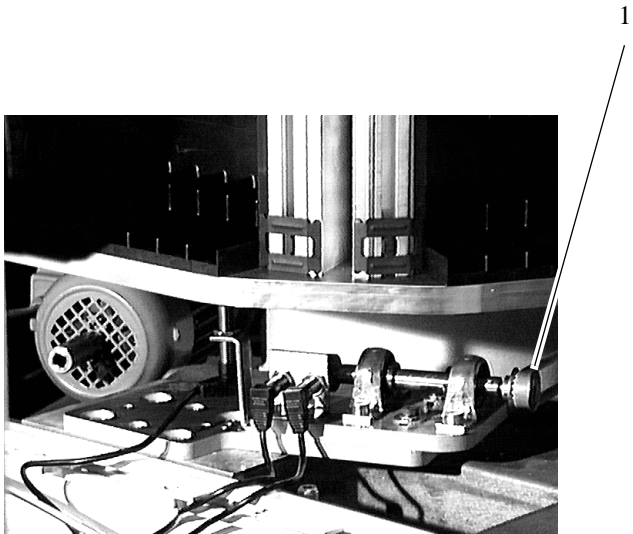


Fig. 8-22: Position Switch on Hexa Tower

Quadro Tower 1

Unit	Location	Job	Fig.	Interval [year]	Time [min]
Auxiliary tower drive (2, 5)	drive unit behind the right cover	check for tightness	8-23, 8-25	0.5	5
Main tower drive (1)	drive unit behind the left cover	check for tightness	8-23	0.5	
Cross roller bearing (4)	grease nipple next to the auxiliary tower drive	grease with 100 g Retinax EP2 (Shell) (ca. 8 time pressed)	8-24	1	10
Four-point bearing (3)	grease nipple next to the auxiliary tower drive	grease with 100 g Retinax EP2 (Shell) (ca. 8 time pressed)	8-24	1	

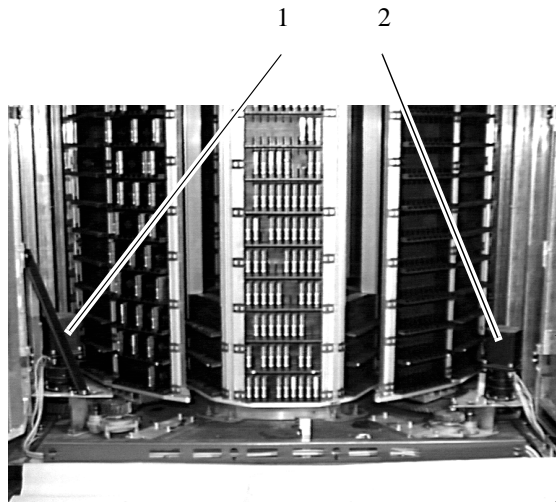


Fig. 8-23: Drive Units of the Quadro Tower

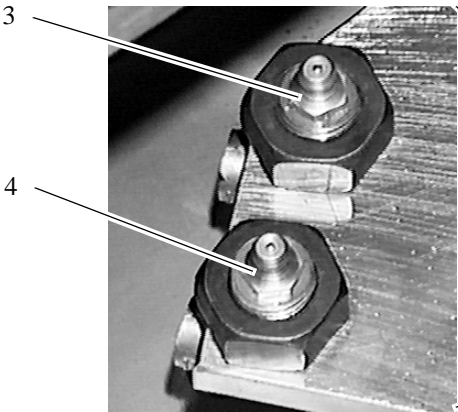


Fig. 8-24: Detail Grease Nipples

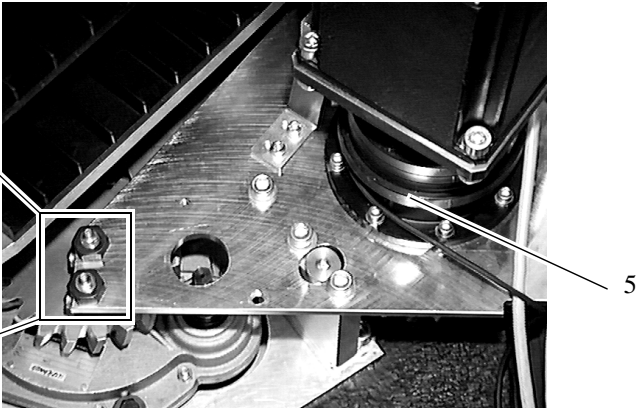


Fig. 8-25: Nipples next to the Auxiliary Tower Drive

## Mechanic Maintenance

### Quadro Tower 2

Unit	Location	Job	Fig.	Interval [year]	Time [min]
Grease nipples for toothed wheel MT - drive (1)	Below Quadro Tower embossed sheets • on the side of the main tower (left-hand side)	<ul style="list-style-type: none"> <li>disassemble the embossed sheets</li> <li>move MT manually with ca.1 turn/sec.</li> <li>grease nipples by pressing 9 times the grease gun (one time pressing/4 sec.) Grafloscon (ca. 18 g grease)</li> <li>move MT 10 turns (spreading of grease)</li> <li>repeat greasing</li> <li>repeat spreading the grease by turning</li> </ul>	8-26 8-27	1	45
Grease nipples for toothed wheel AT - drive (2)	Below Quadro Tower embossed sheets • on the side of the auxiliary tower (right-hand side)	<ul style="list-style-type: none"> <li>move AT manually with ca.1 turn/sec.</li> <li>grease nipples by pressing 9 times the grease gun (one time pressing/4 sec.) Grafloscon (ca. 18 g grease)</li> </ul>	8-26	1	
Turning grease nipples AT - Hexa tower toothed wheels (3)	Left-hand side, below MT segments	<ul style="list-style-type: none"> <li>turn MT until you can handle the 1st grease nipple</li> <li>move AT manually with ca.1 turn/sec.</li> <li>grease nipples by pressing 12 times the grease gun (one time pressing/4 sec.) Grafloscon (ca. 24 g grease)</li> <li>do the same at the 2nd grease nipple</li> </ul>	8-26 8-28	1	

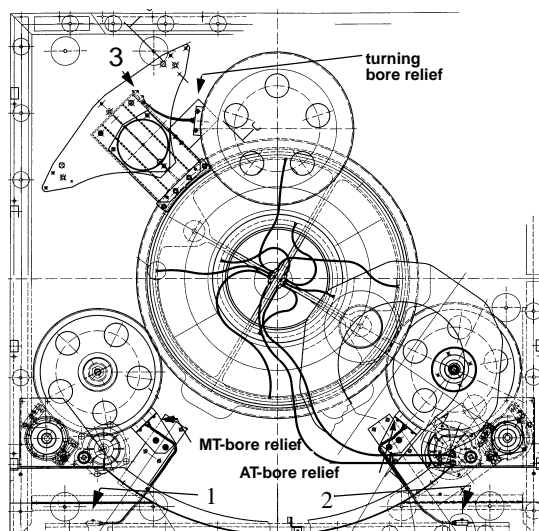


Abb. 8-26: Location of lubrication bore reliefs



Abb. 8-27: Grease nipple Main Tower drive side (left-hand side)

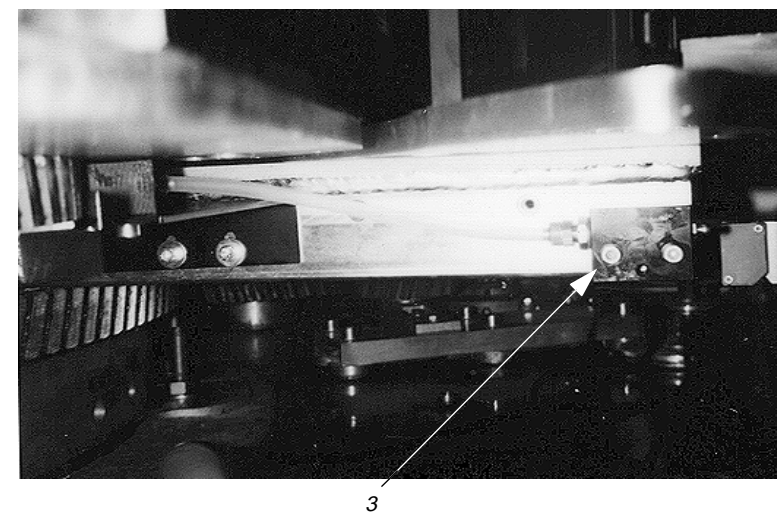


Abb. 8-28: Grease nipple below turning MT segments

## Electric Maintenance (Control Cabinet)

### 8.5 Electric Maintenance (Control Cabinet)

Unit	Location	Job	Fig.	Interval [year]	Time [min]
<EMERGENCY STOP> circuit	<EMERGENCY STOP> button on the I/O unit	check the function		0.5	5
Door lock	archive access (door)	<ul style="list-style-type: none"><li>• check the electric function</li><li>• check the lock mechanism (lock must click into place audibly and must remain locked during operation)</li></ul>		0.5	
	I/O door				
	Quadro tower guard door				
Plugged and clamped connections	AMU operating console	check		1	
Filter mats of fans (2)	control unit	check degree of contamination <ul style="list-style-type: none"><li>• if necessary clean in soap water, <b>dry</b>, and reinsert dry</li><li>• replace them when they are badly contaminated</li></ul>	8-29	1	15
CP/MEM board below the cover (EPROM module, battery)	control unit	replace buffer battery (alcalene-manganese battery 4.5 V) <ul style="list-style-type: none"><li>• remove cover (1)</li><li>• remove old battery</li><li>• short new battery for a short while then insert it; observe proper polarity!</li><li>• record date of battery replacement on the cover</li><li>• mount the cover (1)</li></ul>	8-29	1	
			8-29		
Battery	AMU PC	exchange the battery: <ul style="list-style-type: none"><li>• IBM PC Order no. 15A 230 164</li><li>• SNI PC Order no. 15G 360 001</li></ul>	-	2	10

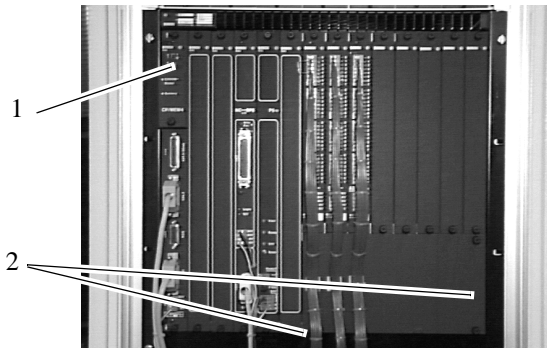


Fig. 8-29: rho Control Unit

# 9 Repair of Mechanic Components

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## 9.1 For Your Safety

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According to German accident prevention rules and standards VBG 4, VDE 0105 and VDI 2853 repair work must be carried out exclusively by trained personnel.

A precondition is knowledge of the safety rules for work on electrotechnical equipment.



### **WARNING!**

**During all work observe the safety rules in chapter 3 “For Your Safety” (☞ page 3 - 1).**

## 9.2 Preparations

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### **WARNING!**

**All repair work must be carried out only when the system is switched off and voltageless.**

**Shut the AML/E system down before (☞ Operator Guide) and secure it against switch on.**

### **Exceptions:**

- **functional checks**
- **measurement of parameters**

Attach a warning sign (☞ page 3 - 12).

## 9.3 Putting Back into Service

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**WARNING!**

Before starting the AML/E system be sure the start will not

- endanger people,
- damage property.

Start the AML/E system (➡ Operator Guide).



### 9.4 Handling Unit

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#### 9.4.1 Cables

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Replace individual defective cables.

(If necessary the hole trailing cable set for handling unit(see page 9 - 3))

##### **Dismounting**

- a) Open cable duct
- b) Unplug cable on both ends
- c) Pull cable out

##### **Mounting**

- a) Insert cable
- b) Plug cable in on both ends
- c) Close cable duct

#### 9.4.2 Trailing cable set for handling unit

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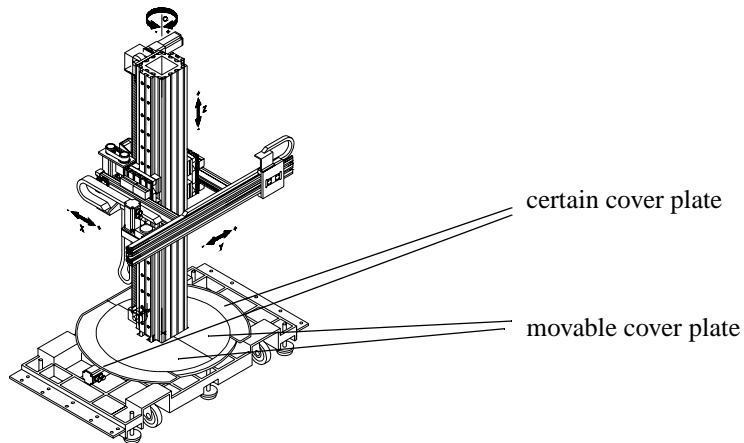
Typ:	Order number:
small	15W200033
middle	15W200034
large	15W200035



##### **Information**

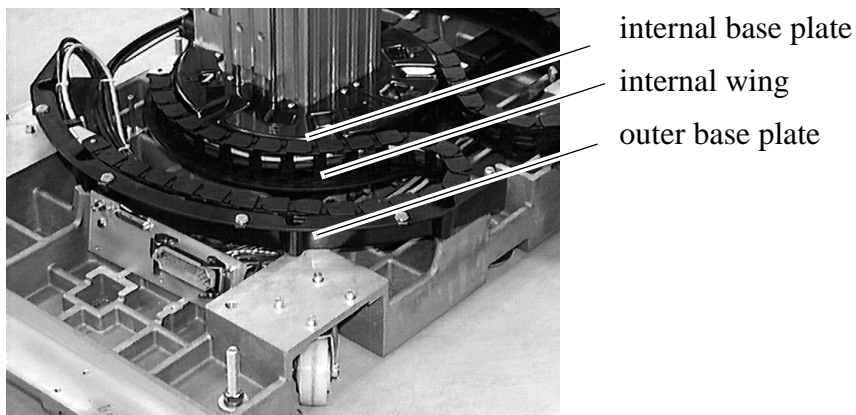
**You receive the trailing cable set completely with all mounting angles and plugs.**

## Dismounting



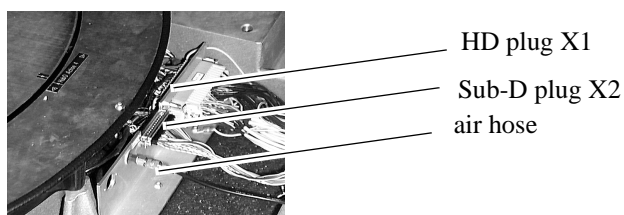
*Fig. 9-1: Handling unit*

- a) Remove the two certain cover plates of the axis of spin
- b) Remove the two movable cover plates of the axis of spin
- c) Remove the embossed sheet



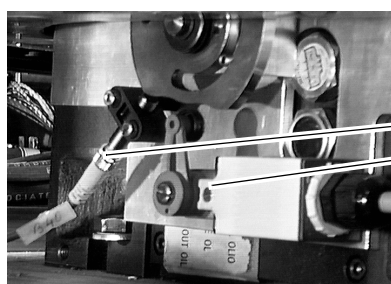
*Fig. 9-2: Axis of spin without cover*

- d) Remove the internal and the outer wing at the cable routing at the axis of spin
- e) Release the two outer black plastic base plates of the cable routing
- f) Release the both internal black plastic base plates of the cable routing



*Fig. 9-3: Cable connections from handling unit*

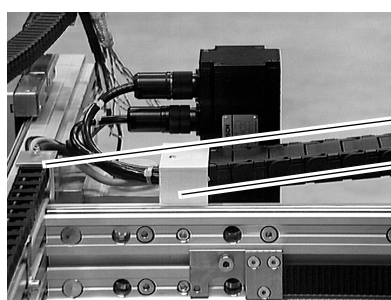
- g) Disconnect all plugs to the cable routing
- X1 (HD plug at the connecting panel)
  - X2 (Sub-D plug at the connecting panel)
  - X48 (motor plug axis 4)
  - X49 (resolver plug axis 4)
  - B40 (reference position switch axis 4)
  - X38 (motor plug axis 3)
  - X39 (resolver plug axis 3)
  - B30 (reference position switch axis 3)
  - X28 (motor plug axis 2)
  - X29 (resolver plug axis 2)
  - B20 (reference position switch axis 2)
  - X18 (motor plug axis 1)
  - X19 (resolver plug axis 1)
  - B10 (reference position switch axis 1)
  - 1X2 (gripper plug)
- h) Release the air hose connection
- at the gripper
  - at the connecting flange



B40 (reference position switch axis 4)  
S1 (hardware limit switch from the axis of spin)

*Fig. 9-4: sensors from the axis of spin*

- i) Unscrew the hardware limit switch from the axis of spin(S1)
- j) Release the connecting flange
- k) Remove the holding-down device at the Y-Axis
- l) Unscrew the cable clip at the gripper slide



connection Y-axis  
connection X-axis



*Fig. 9-5: Fastening from trailing cable set at X-axis and Y-axis*

- m) Unscrew the fastening from gripper trailing cable set at the Y-axis
- n) Unscrew the fastening from trailing cable set at the X-axis



*Fig. 9-6: Fastening from trailing cable set at Z-axis*

- o) Unscrew the fastening from trailing cable set at the Z-axis
- p) Unscrew the cable trough completely at the Z-axis
- q) Cut still possibly holding cable straps
- r) Lifting the complete trailing cable set from the equipment

### Mounting

The installation results in reverse sequence



#### **ATTENTION !**

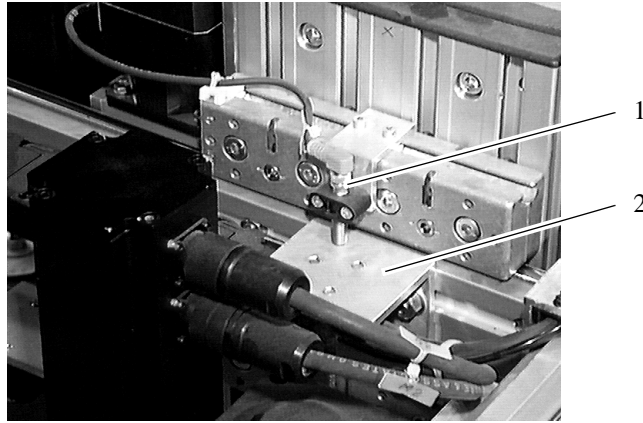
**Note at the installation following things:**

- **cables in the cable duct du not twist**
- **no loops in the cables form**
- **cables before sharp edges protect**
- **use streps to fasten loosely cable ends and loops**

### 9.4.3 Reference Switch on Axis 1

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left upper support bearing on axis 1



*Fig. 9-7: Reference Switch on Axis 1*

#### **Dismounting**

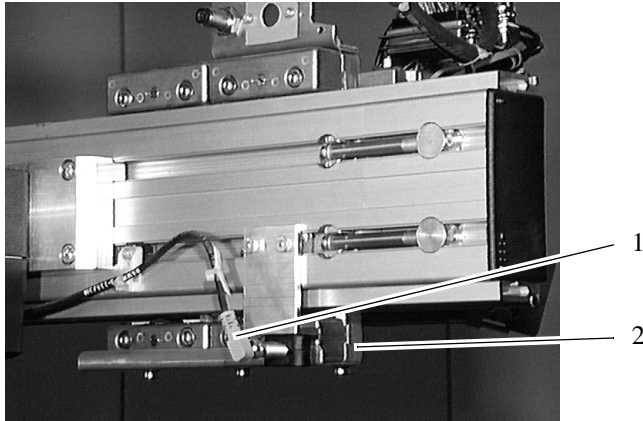
- a) Put bracket (2) below the reference switch (1)
- b) Unplug and dismount the reference switch

#### **Mounting**

- a) Mount the reference switch
  - adjust distance to 1 mm
- b) Plug in the reference switch
- c) Check the reference point and adjust the resolver zero-point (HPO) if necessary  
(👉 page 9 - 50)

#### 9.4.4 Reference Switch on Axis 2

left end of axis 2




*Fig. 9-8: Reference Switch on Axis 2*

#### Dismounting

- a) Position the carriage (2) behind the reference switch (1)
- b) Unplug and dismount the reference switch

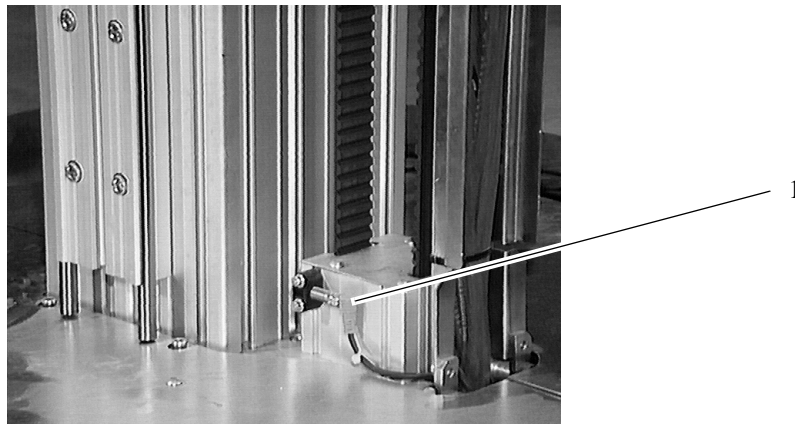
#### Mounting

- a) Mount the reference switch
  - adjust distance to 1 mm
- b) Plug in the reference switch
- c) Check the reference point and adjust the resolver zero-point (HPO) if necessary  
( page 9 - 50)

### 9.4.5 Reference Switch on Axis 3

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bottom end of the column



*Fig. 9-9: Reference Switch on Axis 3*

#### **Dismounting**

- a) Move to the reference point of axis 3
- b) Unplug and dismount the reference switch (1)

#### **Mounting**

- a) Mount the reference switch
  - adjust distance to 1 mm
- b) Plug in the reference switch
- c) Check the reference point and adjust the resolver zero-point (HPO) if necessary  
(☞ page 9 - 50)

#### 9.4.6 Reference Switch on Axis 4 (Turning Axis)

on the drive gear of the turning axis

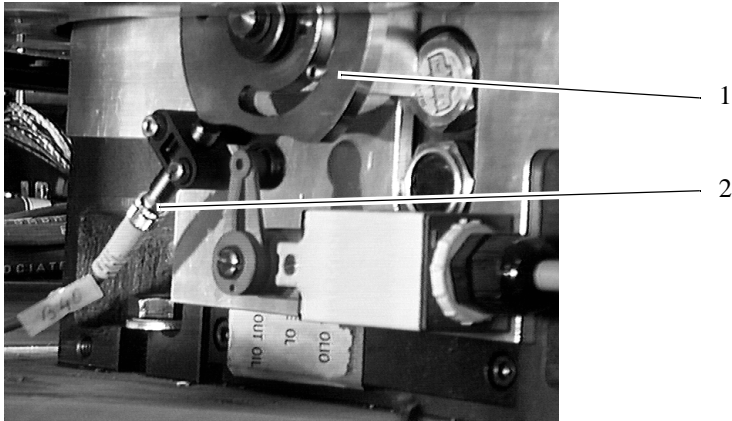


Fig. 9-10: Reference Switch on Axis 4

#### Dismounting

- a) Position the cam wheel (1) above the reference switch (2)
- b) Unplug and dismount the reference switch

#### Mounting

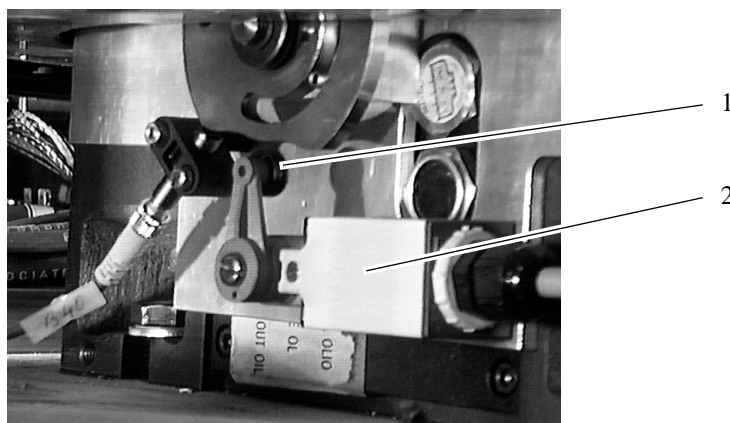
- a) Mount the reference switch
  - adjust distance to 1 mm
- b) Plug in the reference switch
- c) Check the reference point and adjust the resolver zero-point (HPO) if necessary  
(see page 9 - 50)



### 9.4.7 Limit Switch on Axis 4

---

on the drive gear of the turning axis



*Fig. 9-11: Limit Switch on Axis 4*

#### **Dismounting**

- a) Mark the position of the defective limit switch (2)
- b) Dismount and disconnect the limit switch
  - open the cover
  - note the terminal connections
  - disconnect the cable

#### **Mounting**

- a) Connect the new limit switch
  - open the cover
  - connect terminals the way the defective limit switch was connected
  - close the cover
- b) Mount the limit switch
  - adjust the pulley (1) the way it was adjusted on the defective limit switch
  - align it with the marks
- c) Check the function

### 9.4.8 Motor Axis 1

on carriage of axis 1

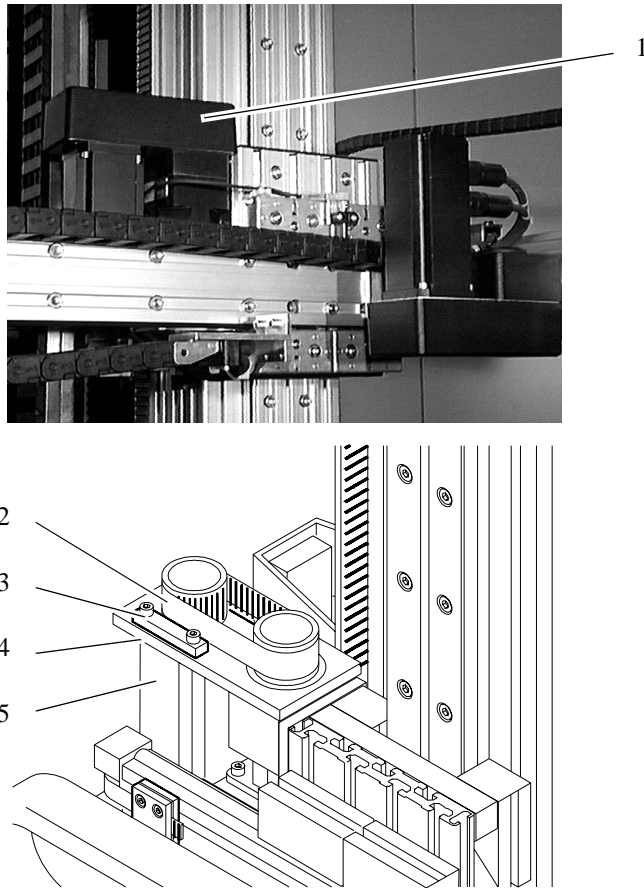


Fig. 9-12: Motor of Handling Unit on Axis 1

#### Dismounting

- a) Pull both motor plugs
- b) Dismount the cover (1)
- c) Loosen the fastening screws (3)
- d) Dismount the drive belt (2)
- e) Hold the motor (5) and dismount it from the motor base (4)

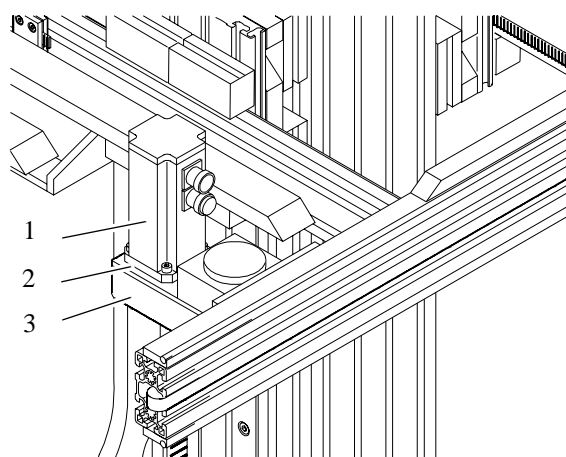
### Mounting

- a) Insert the motor (5) into the motor base (4) and lightly tighten the fastening screws
- b) Put the drive belt (2) on
- c) Tension the drive belt (→ page 8 - 6)
- d) Mount the cover (1)
- e) Plug in both motor plugs
- f) Adjust the resolver zero-point (HPO) (→ page 9 - 50)

#### 9.4.9 Motor Axis 2

---

carriage on axis 1



*Fig. 9-13: Motor of Handling Unit on Axis 2*

### Dismounting

- a) unplug both motor plugs
- b) remove the cover (3)
- c) hold the motor (1) and dismount it from the motor base (2)

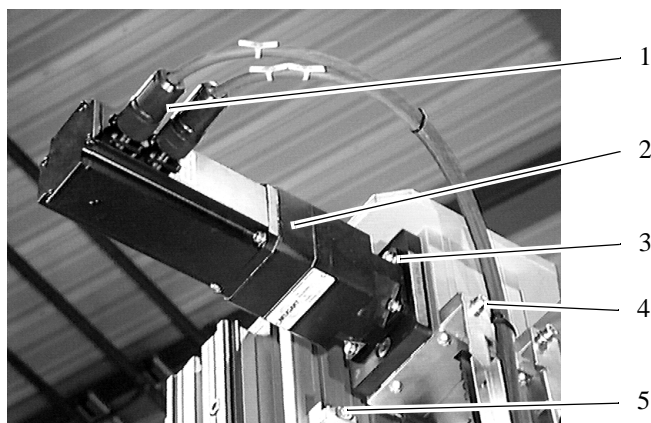
### Mounting

- a) Insert the motor (1) and lightly tighten the screws
- b) Put the drive belt on
- c) Tension the drive belt (→ page 8 - 6)
- d) Mount the cover (3)
- e) Plug in both motor plugs
- f) Adjust the resolver zero-point (HPO) (→ page 9 - 50)

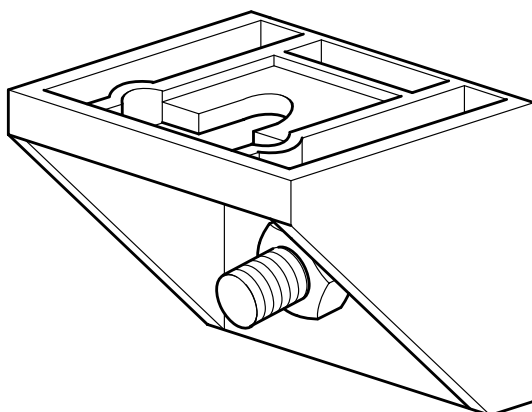
### 9.4.10 Motor Axis 3 with Gears

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on top of the column



*Fig. 9-14: Motor with Gears of the Handling Unit on Axis 3*



*Fig. 9-15: Clamping Device*

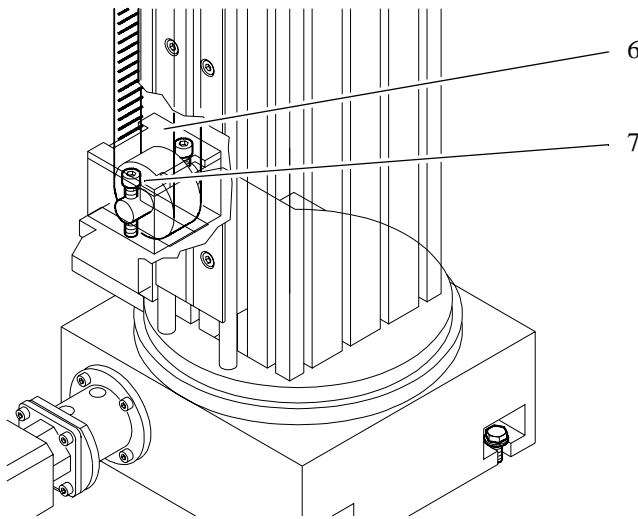


#### **WARNING!**

**Be sure to secure axes 1 and 2 with the clamping device before dismounting the motor.**

**The brake on the motor blocks the axes. When you dismount the motor the axes are unblocked and slide down!**

### Dismounting



*Fig. 9-16: Drive Belt Tensioning Pulley and Clamping Device on Axis 3*

- a) Mount the clamping device below axis 1
- b) Release the drive belt tension
  - remove the cover (6) of the deflection pulley
  - release the tension of the drive belt with the tensioning screws (7)
- c) Unplug both motor plugs (1)
- d) Lower motor and gears (2)
  - remove screws on plate (4)
  - loosen stoppers (5) and retighten them approx. 5 cm further down
  - loosen the flange plate and lower it to the stoppers
- e) Dismount the motor with the gears (2)

### Mounting

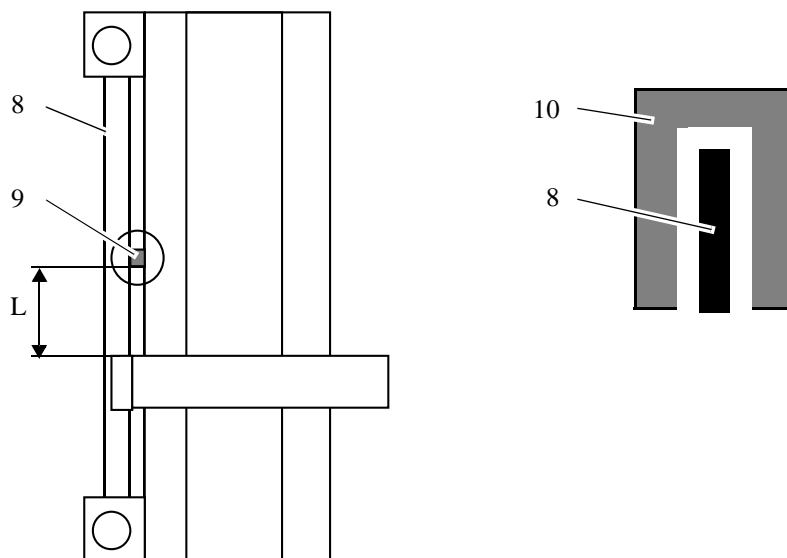
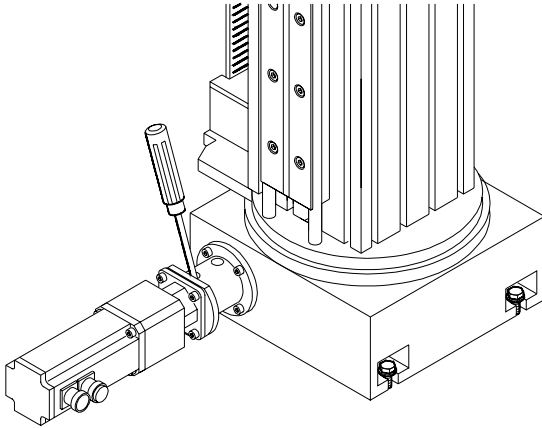


Fig. 9-17: Drive Belt Tensioning on Axis 3

- f) Insert the motor with the gears (2) and tighten the screws (3) with torque  $M = 5 \text{ Nm}$
- g) Lift motor with gears (2)
  - loosen the flange plate and push it up until it is level with the end of the column (original position)
  - push the stoppers (5) below the flange plate and tighten them
  - tighten the screws on the plate (4)
- h) Plug in both motor plugs
- i) Adjust the drive belt tension (measuring device: Clavis by MULCO)
  - wet the threads of the tensioning screws with Loctite
  - tension the drive belt evenly with the tensioning screws
  - put the block (9) behind the drive belt (8) and limit the vibrating length to  $L = 310 \text{ mm}$  (press the drive belt down)
  - hold the measuring bracket (10) above the center of the drive belt (8), but don't touch it
  - strike the drive belt normal to its running direction
  - setpoint:  $f = 120 \pm 10 \text{ Hz}$  (value confirmed acoustically)
  - evenly adjust the tension with the tensioning screws (7)
  - mount the cover (6) of the deflection pulley
- j) Dismount the clamping device
  - check the function of the handling unit and re-teach it if necessary
  - adjust the resolver zero-point (HPO) (see page 9 - 50)

### 9.4.11 Motor Axis 4 with Gears

bottom end of the column



*Fig. 9-18: Motor with Gears of the Handling Unit on Axis 4*

#### Dismounting

- a) Dismount covers and cable ducts
- b) Loosen the screws on the metal sheathing through the flange opening
- c) Dismount the flange from the rotary table and turn it until all motor screws are accessible
- d) Separate the motor from the flange, hold the metal sheathing coupling on the axis as you pull the motor off (☞ sketch above)

#### Mounting

- a) Remount the motor in opposite sequence
- b) Adjust the resolver zero-point (HPO) (☞ page 9 - 50)



### 9.4.12 Drive Belts on Axis 1

#### Position

on carriage of axis 1

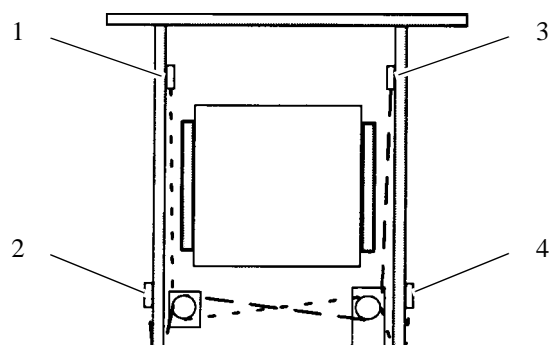


Fig. 9-19: Drive Belt Path on Axis 1

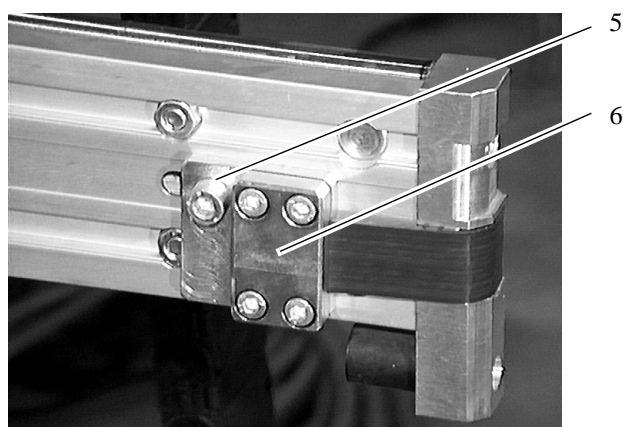


Fig. 9-20: Drive Belt Lock on Axis 1



#### Information

Axis 1 has two drive belts which are always replaced together.

- drive belt 1 runs from (1) to (4)
- drive belt 2 runs from (3) to (2)

Follow the subsequent steps for both drive belts.

### Dismounting

- a) Loosen the screw (5) on (1) or (3); the belt tension is released
- b) Open the drive belt locks (6)
- c) Remove the drive belt

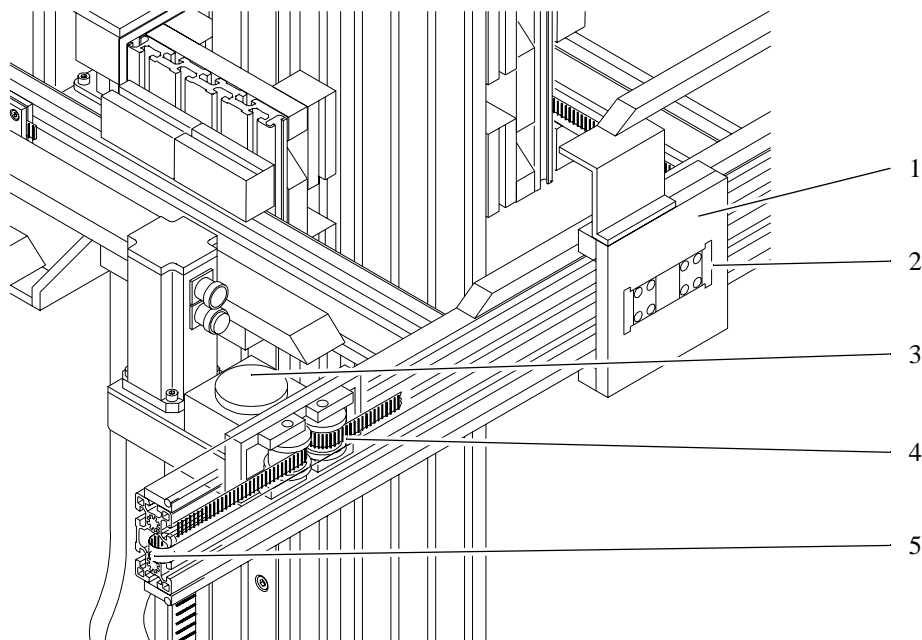
### Mounting

- a) insert the drive belt
- b) Put the drive belt into the drive belt lock and clamp it
- c) Tension both belts (🔗 page 8 - 3)
- d) Adjust the resolver zero-point (HPO) (🔗 page 9 - 50)

### 9.4.13 Drive Belt on Axis 2

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in the carriage guide on axis 2

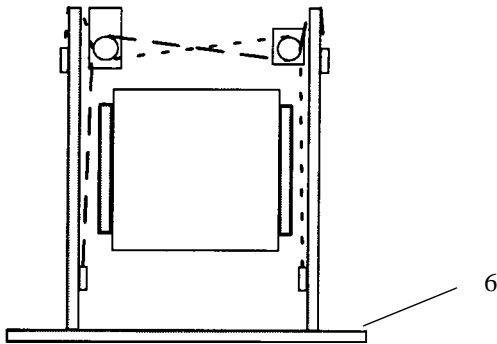


*Fig. 9-21: Replacing the Drive Belt on Axis 3*

#### **Dismounting**

- a) Move the carriage (1) to the left stopper
- b) Dismount the gripper with the flange
- c) Open the drive belt locks (2) and dismount the drive belt
- d) Dismount the motor with the transmission gears (3)

### Mounting



*Fig. 9-22: Inserting the Drive Belts on Axis 2*

- a) Insert the new drive belt on the right rear end of the carriage guide (6)
- b) Pull the drive belt from the opening and put it around the pulley (4)
- c) Pull the drive belt to the carriage across the deflection pulleys (5)
- d) Insert the drive belt into the drive belt locks and clamp it
- e) Tension the drive belt (☞ page 8 - 4)
- f) Mount the gripper with the flange
- g) Adjust the resolver zero-point (HPO) (☞ page 9 - 50)

### 9.4.14 Drive Belt on Axis 3

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on the column

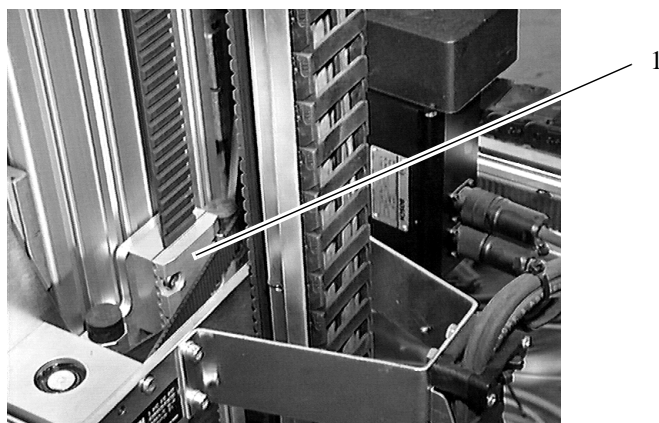


Fig. 9-23: Drive Belt Lock on Axis 3

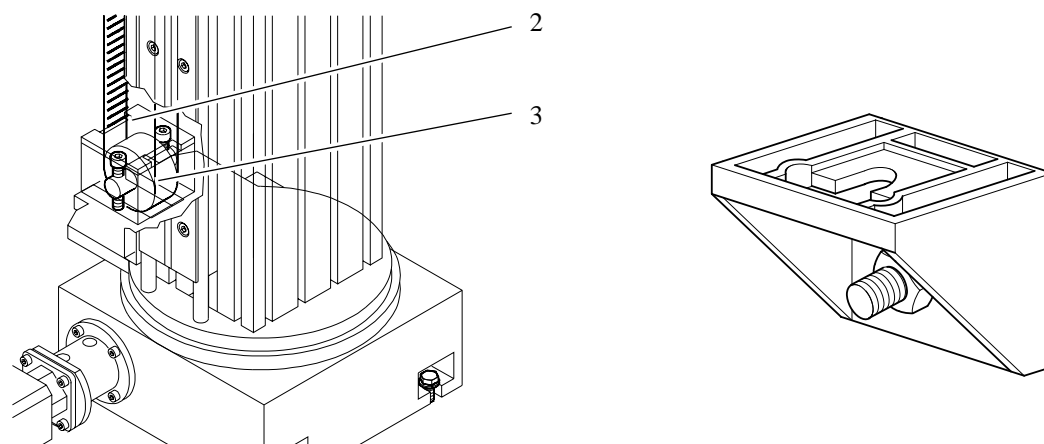


Fig. 9-24: Deflection Pulley on Axis 3 and Clamping Device



#### **WARNING!**

**Be sure to secure axes 1 and 2 with the clamping device before dismounting the motor.**

**The brake on the motor blocks the axes. When you dismount the motor the axes are unblocked and slide down!**

### Dismounting

- a) Mount the clamping device below axis 1
- b) Open the drive belt lock (1) take off the drive belt
- c) Dismount the cover (2)
- d) Dismount the tensioning pulley (3)

### Mounting

- a) Insert the new drive belt
- b) Insert the drive belt into the drive belt lock (1) and clamp it
- c) Mount the tensioning pulley (3) and lightly pretension it
- d) Dismount the clamping device
- e) Tension the drive belt (🔧 page 8 - 5)
- f) Adjust the resolver zero-point (HPO) (🔧 page 9 - 50)

### 9.5 Gripper

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#### 9.5.1 Parallel gripper

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##### Information

- **Gripper for large media: order no. 401 004 920**  
(gap between jaws > 3 mm)  
for 1/2 Inch cartridges, VHS, TK, DTF-Large, 8mm-cartridges (Exabyte), Travan, D2 Small and D2 Medium
- **Gripper for small media: order no. 401 004 930**  
(gap between jaws ca. 3 mm)  
for 1/2 Inch cartridges, VHS, TK, DTF-Large, 8mm-cartridges (Exabyte), Travan, OD-Reflection, OD-512, 4mm DDS, CD-ROM (Caddy)

##### Tools and aids

- Slotted screwdriver, small
- Allan key 4 mm

### 9.6 Software Backup

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- a) Do a Software Backup (☞ Software Backup):
- Robot & Tower Software (old controller software)
  - save files „C:\AMU\AMUCONF.INI“, „C:\AMU\KRNREFPT.R01“
  - save via **RFM** (☞ Rho File Manager) in AMU-menu **Service** the files „\*.BIN“, „\*.DAT“ in directory „C:\ROBOT\BACKUP“

## 9.7 Install new software and edit the parameters

- Copy the installation disk on your hard disk
- Unzip the software
- Copy all files you need in a work directory

from directory	file	needed with	rename in
bin	max2_kin.rho	System with no or one Quadro tower (equals version 2.2.0)	mprho3.bin
	max3_kin.rho	System with two Quadro towers (equals version 2.2.0)	mprho3.bin
	mprho3.bin		
	read.me		
pic	iq_amle.p2x	always necessary (control program PIC)	iq_aml2.p2x
prs	alle	copy in directory MOOG for parameterizing of drive amplifiers	
sourcen	init.ird	always necessary	
	perman.ird		
	amulese.ird		
	amuschr.ird		
	fteach.ird		
	frack.ird		
	fbarcode.ird		
	fnewgrip.ird		
	ftest.ird		



## Install new software and edit the parameters

from directory	file	needed with	rename in
	qturm1.ird	necessary in systems with one Quadro tower	
	qturm2.ird	necessary in systems with two Quadro towers	
	hturm.ird	necessary in systems with Hexa towers	
	flwmulti.ird	necessary for all drives except for 3490	
	flw3490.ird	necessary for 3490 drives	
	flw3480.ird	necessary for 3480 drives with flap	
	exprog.dat	always necessary (Do not change the files!)	
	version.dat		
	kopplung.dat		
	ftest.ger	needed for German Robot Test Program	ptest.dat
	ftest.dat	needed for English Robot Test Program	
	homepos.dat	always necessary (equals version 2.2.0)	
	konfig.bas	always necessary, copy the parameters of version 2.2.0 or determine new	konfig.dat
	flw34907.dat	necessary if a drive is defined in AMU as D7	
	flw34909.dat	necessary if a drive is defined in AMU as D9	

d) Edit file KONFIG.DAT:

- Take on the parameters as described in the table below (☞ Software Backup)

Versions 2.20		Version 2.30			Explanation
Pos.	Parameter	Pos.	Parameter	Act.	
Addresses					
1	T_ADR_RHO	1	T_ADR_RHO		Logical address of the control unit (same syntax as AMU configuration: O01).
3	T_EA1_Typ	2	T_EA1_Typ		Type of the first I/O unit (same syntax as AMU: E2, E3).
5	G_EA1_Nr	3	G_EA1_Nr		Logical number of the first I/O-unit. E001... means value 1
7	G_RobotNr	4	G_RobotNr		Logical number of the robot.  1 = robot 1 2 = robot 2
Use for each media type always the affiliated values, eg media type 1 -> Offset media type 1, barcode recognition media type 1 etc.					
8	T_Cart_Typ1	5	T_Cart_Typ1		media type 1
9	T_Cart_Typ2	6	T_Cart_Typ2		media type 2
10	T_Cart_Typ3	7	T_Cart_Typ3		media type 3
		Assignment of the drive types Same syntax as AMU configuration: eg D3, D8, D9, DO... Use for each drive type always the affiliated offsets. Not used drive types you have to fill up with „--“.			
59	LW1	78	LW1		drive type 1
60	LW2	79	LW2		drive type 2
61	LW3	80	LW3		drive type 3
62	LW4	81	LW4		drive type 4
71	FZ_Unload[1]	92	FZ_Unload[1]		Y = gripper presses unload button ( <b>Get</b> ), N = gripper does not press the unload button (only for OD, VHS, DLT)

## Install new software and edit the parameters

Versions 2.20		Version 2.30			Explanation
Pos.	Parameter	Pos.	Parameter	Act.	
		Offset gripper handling and barcode recognition for drive type 2 [1/100 mm]			
80	FZ_Unload[2]	100	FZ_Unload[2]		Y = gripper presses unload button ( <b>Get</b> ), N = gripper does not press the unload button (only for OD, VHS, DLT)
		Offset gripper handling and barcode recognition for drive type 3 [1/100 mm]			
89	FZ_Unload[3]	100	FZ_Unload[3]		Y = gripper presses unload button ( <b>Get</b> ), N = gripper does not press the unload button (only for OD, VHS, DLT)
		Offset gripper handling and barcode recognition for drive type 4 [1/100 mm]			
98	FZ_Unload[4]	108	FZ_Unload[4]		Y = gripper presses unload button ( <b>Get</b> ), N = gripper does not press the unload button (only for OD, VHS, DLT)
105	G_Z_MAXLIMIT	141	G_Z_MAXLIMIT		maximal z-coordinate [1/100 mm] small = 143500 medium = 181900 high = 218900
106	G_Z_MINLIMIT	142	G_Z_MINLIMIT	0	minimal z-coordinate [1/100 mm]
		Speed and Acceleration			
113	D_HANDL	143	D_HANDL		Slow speed for linear interpolation (during handling): min. 10 / max. 350

Versions 2.20		Version 2.30			Explanation
Pos.	Parameter	Pos.	Parameter	Act.	
		Diagnosis			
116	G_PHGECHO	144	G_PHGECHO		0 = PHG not connected, normal working conditions,  1 = PHG necessary, tests possible,  2 = PHG connected, only test mode, stand-alone  3 = PHG connected, only test mode, stand-alone without gripper
		Timeout			
117	D_TIME1	145	D_TIME1	30	time-out Quadro tower (in sec)
118	D_TIME2	146	D_TIME2	10	time-out I/O unit (in sec)
120	D_WARTE_KEEP	147	D_WARTE_KEEP		time-out for <b>Keep</b> (in sec)
136	G_BCErrIgn	149	G_BCErrIgn		Reaction on barcode-reading error (only on RC=502). 0 = cancel on error 1 = ignore error and continue
168	D_Konf_Korr	150	D_Konf_Korr		additional move of the gripper on the y-axis to the middle posi- tion during turn of the c-axis (in mm)
		Offset <b>barcode</b> recognition for <b>second label on optical disc</b>			
159	FG_Z_BC_OD[1]	159	FG_Z_BC_OD[1]		positive z-value = gripper up for media typ 1
160	FG_Z_BC_OD[2]	160	FG_Z_BC_OD[2]		positive z-value = gripper up for media typ 2
161	FG_Z_BC_OD[3]	161	FG_Z_BC_OD[3]		positive z-value = gripper up for media typ 3

e) Enter the gripper type parameter

Pos.	Parameter	Actual	Explanation
148	G_Parallel		Gripper type: 0 = for small media (order no. 401 004 930) 1 = for large media (order no. 401 004 920)

## Install new software and edit the parameters

f) Enter the parameters of the gripper data sheet

Pos.	Parameter	Actual	Explanation
Teach sensor offset (☞ gripper data sheet)			
152	G_Y_BC		barcode-scanner offset horizontal
153	G_X_TEACH		sensor (bow in front ) offset (in 1/100 mm)
154	G_Y_TEYCH		teach sensor offset horizontal (in 1/100 mm)
155	G_Z_TEACH		teach sensor offset vertical (in 1/100 mm)
Gripper offset (☞ gripper data sheet)			
156	G_X_OFFSET		gripper offset x-coordinate (in 1/100 mm)
157	G_Y_OFFSET		gripper offset y-coordinate (in 1/100 mm)
158	G_Z_OFFSET		gripper offset z-coordinate (in 1/100 mm)

g) Send the new software to the rho control via **Rho File Manager** (☞ AMU Reference Guide „Rho File Manager“)

## 9.8 Adjust the drives

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### Information

All standard drives have example files (including the parameters) on the installation diskette (e.g. `flwodr.dta`).

If you don't find the corresponding file for your drive or if you have handling problems then edit the following parameters:

- a) Edit your drive files as described:
  - e.g. an ODR-drive (**00**) was declared first in „KONFIG.DAT“ then enter  
`copy flwodr.dta plwdat1.dat`
  - define for each other drive the file „FLWDAT?.DAT“ (?=1..7), max. 7 different drive types are possible
  - define for the DTF medium and small as well as for the D2 medium and small for each 2 drive types
- b) Send the files to the control via **Rho File Manager** (→ AMU Reference Guide „Rho File Manager“)
- c) Restart your system

### 9.8.1 Meaning of the drive parameters

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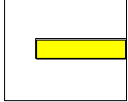
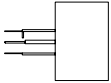
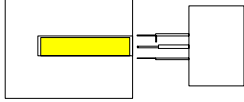
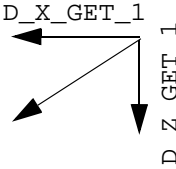
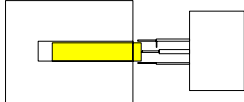
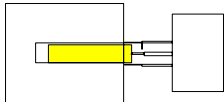
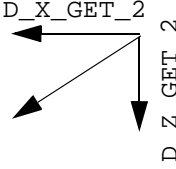


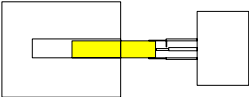
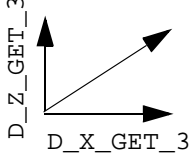
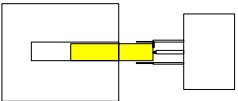
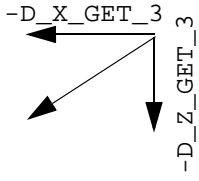
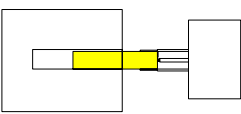
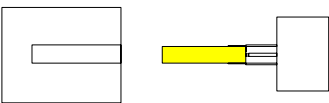
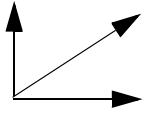
### Information

If wait times and movements have value „0“, the corresponding function is switched off.

Speed factors need not to have value „0“.

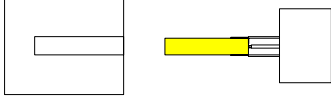
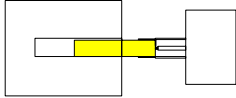
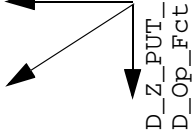
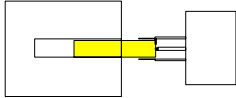
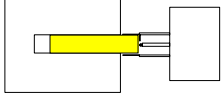
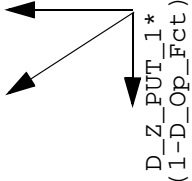
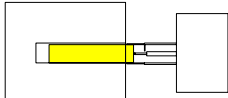
### GET command

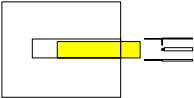
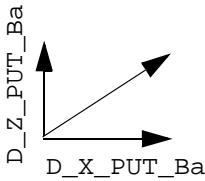
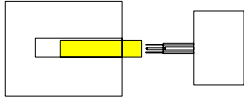
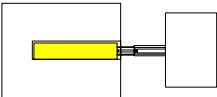
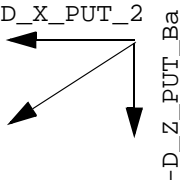

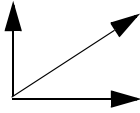
Situation	Parameter	Explanation
<p>drive</p>  	<p>INIT</p> <p>(X, Y, Z, tilt angle, angle offset cover)</p>	<p>Start position for drive handling. The parameters are added to the teach points.</p>
<p>1st movement</p> <p>drive</p> 	 <p>D_X_GET_1</p> <p>D_Z_GET_1</p> <p>D_Vel_FctG1</p> <p>G_Detect</p>	<p>First movement at Get com- mand. Speed can be changed via parameter D_Vel_FctG1 in area 0.1 - 1. Target of that movement is the position where the gripper waits for the medium.</p> <p>Parameter G_Detect gives the status of the pusher while waiting:</p> <ul style="list-style-type: none"> <li>• 0 = Pusher pressure reduced</li> <li>• 1 = Pusher without pressure</li> </ul>
<p>drive</p> 	<p>D_Wait_Get</p>	<p>After Unload of medium (pusher sensor active) the robot waits as long as entered in parameter D_Wait_Get (seconds)</p>
<p>2nd movement</p> <p>drive</p> 	 <p>D_X_GET_2</p> <p>D_Z_GET_2</p> <p>D_X_Put_Ra</p>	<p>The second movement brings the gripper to the position where it's being closed.</p> <p>On that position the gripper is closed immediately</p> <p>If regip is not possible: reduction of the depth via parameter D_X_Put_Ra for the following <b>Put</b>.</p>

Situation	Parameter	Explanation
<p>3rd movement</p> <p>drive</p> 		<p>Via sensor „Pusher in the back“ the gripper recognizes if the medium was gripped correctly:</p> <ul style="list-style-type: none"> <li>• medium gripped correctly: robot moves immediately to end position</li> <li>• medium not gripped correctly: gripper opens and Regrip routine is started</li> </ul>
<p>4th movement, regrip</p> <p>drive</p> 		<p>robot moves near the drive, until the medium will be gripped correctly.</p>
<p>drive</p> 		<p>Gripper is closed</p>
<p>5th movement</p> <p>drive</p> 		<p>Fifth movement leads to the end position</p>

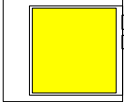
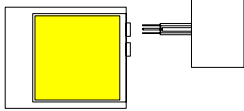
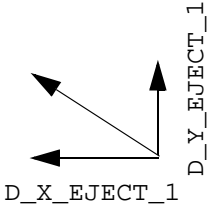
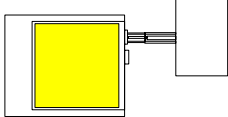
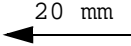
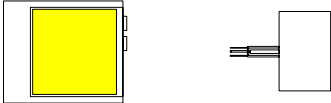
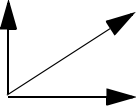


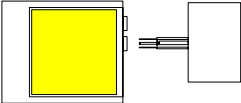
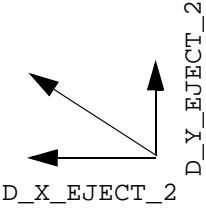
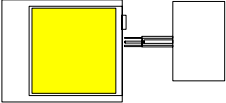
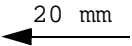
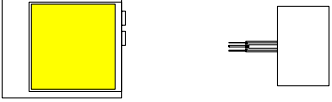
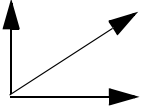
PUT command

Situation	Parameter	Explanation
<p>drive</p> 	<p>INIT</p> <p>(X, Y, Z, tilt angle, angle-offset cover)</p>	<p>Start position for drive handling. The parameters are added to the teach points.</p>
<p>1st movement</p> <p>drive</p> 	<p><math>D\_X\_PUT\_1^*</math> <math>D\_op\_Fct</math></p>  <p><math>D\_Vel\_FctP1</math></p>	<p>First movement at Put com- mand. Speed can be changed via para- meter <math>D\_Vel\_FctG1</math> in area 0.1 - 1. Target of that movement is the position where movement will be converted (inside the drive, how far to get inside)</p>
<p>drive</p> 		<p>Gripper will be opened after in parameter <math>D\_Op\_Fct</math> entered stretch</p>
<p>drive</p> 	<p><math>D\_X\_PUT\_1^*</math> <math>(1-D\_op\_Fct)</math></p>  <p><math>D\_Bg1</math></p>	<p>First movement is continued with opened gripper</p>
<p>drive</p> 		<p>Pushing of the medium with the pusher:</p> <ul style="list-style-type: none"><li>• 1 = medium is pushed with full pressure</li><li>• 2 = medium is pushed with reduced pressure</li><li>• 3 = medium is not pushed</li></ul>

Situation	Parameter	Explanation
2nd movement		Gripper drives back to push
drive		
		
	G_Close	Gripper position while pushing:
drive		
		<ul style="list-style-type: none"> <li>1 = pushing with closed gripper jaws</li> <li>2 = pushing with open gripper jaws</li> </ul>
3rd movement		Movement of pushing with speed entered in D_Vel_Fct_P2
drive		
		
	D_Vel_Fct_P2	
4th movement		Fifth movement leads to the end position
drive		
		

UNLOAD command

Situation	Parameter	Explanation
<div>drive</div> 	G_GRP_DIS	<p>Start position for handling of buttons at the drive (Unload and Not Ready).</p> <p>Via G_GRP_DIS you enter the gripper position for Unload:</p> <ul style="list-style-type: none"><li>• 0 = gripper 0°, pusher reduced pressure</li><li>• 1 = gripper 0°, pusher full pressure</li><li>• 2 = gripper 7°, pusher without pressure</li><li>• 3 = gripper 0°, pusher without pressure</li></ul>
<div>1st movement</div> <div>drive</div> 	 D_X_EJECT_1 D_Z_EJECT_1	<p>First movement at Unload command</p> <p>Closed gripper is positioned 20 mm before the first button</p>
<div>2nd movement</div> <div>drive</div> 		<p>Gripper handles the (first) button</p>
<div>3rd movement</div> <div>drive</div> 		<p>Third movement leads to the start position</p>


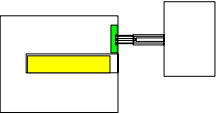
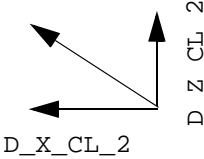
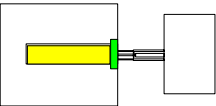

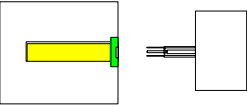
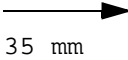
Situation	Parameter	Explanation
	G_Scnd_Btn	Handling of a second button <ul style="list-style-type: none"> <li>1 = handle 2nd button</li> <li>0 = handle only 1 button</li> </ul>
4th movement		Fourth movement at Unload command
drive	 	Closed gripper is positioned 20 mm before the second button
5th movement	 	Gripper handles the (second) button
6th movement	 	Sixth movement leads to the start position

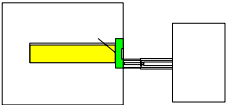
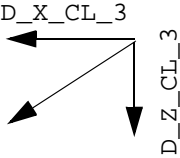

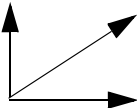
Close Unit command



Information

This configuration is only for linear movements while closing a flap. Use for IBM 3480 drives with flap the routine „PLW3480.IRD“ and the affiliated configuration file.

Situation	Parameter	Explanation
		Start position
<div>drive</div>		
1st movement		First movement at command Close Unit Closed gripper drives into the gap of the flap.
<div>drive</div>		
2nd movement		Gripper drives down
<div>drive</div>		
3rd movement		Gripper quits the flap
<div>drive</div>		

Situation	Parameter	Explanation
<p>4th movement</p> <p>drive</p> 		<p>Gripper tests via pusher sensor if the flap was closed.</p>
<p>5th movement</p> <p>drive</p> 		<p>Sixth movement leads to the start position</p>

### 9.8.2 „FLWDAT?.DAT“ for AML/E, software version 2.3.0

---

Line	Name	Description
9	D_X_PUT_2	Push media into drive
11	D_X_EJECT_1	X-coordinate of 1st Unload button (20mm in front of button). Configuration, if button has to be pressed via KONFIG.DAT
12	D_Y_EJECT_1	Y-coordinate of 1st Unload button
13	D_Z_EJECT_1	Z-coordinate of 1st Unload button
15	G_Scnd_Btn	1= 2nd Unload button has to be pressed 0= no 2nd Unload button
16	D_X_EJECT_2	X-coordinate of 2nd Unload button (20mm in front of button)
17	D_Y_EJECT_2	Y-coordinate of 2nd Unload button
18	D_Z_EJECT_2	Z-coordinate of 2nd Unload button
20	G_CL_U	1=drive flap has to be closed 0= no closing of flap
21	D_X_CL_1	X-coordinate for gripper in depression of drive flap
22	D_Z_CL_1	Z-coordinate for gripper in depression of drive flap
23	D_Z_CL_2	Z-value closing of flap, movement down (of gripper)
24	D_X_CL_3	X-coordinate for testing if flap is closed
25	D_Z_CL_3	Z-coordinate for testing if flap is closed
27	D_X_Put_Ra	Reduced putting down of cartridge at rack if cartridge was at the drive not completely in the gripper and couldn't be regripped at the drive
29	D_X_PUT_1	X-coordinate for putting down the cartridge in the drive, 1st movement
30	D_Z_PUT_1	Z-coordinate for putting down the cartridge in the drive
31	D_Vel_FctP1	Speed factor for the 1st movement 1 = full speed (0.1-1.0)
32	D_Op_Fct	Factor for the 1st movement, from now on the 1st movement will be continued with opened gripper (0-1) 1 = whole movement with gripper closed
33	D_X_PUT_Ba	X-coordinate for movement back and re-pushing again the cartridge with closed gripper. 0 = no re-pushing
34	D_Z_PUT_Ba	Z-coordinate for movement back (re-pushing again)
35	G_Close	1=close gripper for re-pushing
36	G_Bgl	Pusher 1 = Pusher at front on PUT, 0 = Pusher without pressure

Line	Name	Description
37	D_Vel_FctP2	Velocity factor for re-pushing the cartridge into the drive (Distance see value 1, line 52) 1.0 = max. velocity
38	D_Wait_Push	Wait time until the gripper moves out of the drive after re-pushing [sec]
40	D_X_GET_1	X-coordinate for getting the cartridge out of the drive, 1st movement
41	D_Z_GET_1	Z-coordinate for getting the cartridge out of the drive
42	D_Vel_FctG1	Velocity factor for the 1st movement. 1 = full velocity (0.1-1.0)
43	D_Wait_Get	Wait time between recognizing the cartridge and closing the gripper
44	D_X_GET_2	X-coordinate gripper movement forward after recognizing the cartridge
45	D_Z_GET_2	Z-coordinate gripper movement forward after recognizing the cartridge
46	D_X_GET_3	X-coordinate movement backward with the cartridge out of the drive. Query if the cartridge was gripped OK or if there should be a regrip. 0 = no regrip
47	D_Z_GET_3	Z-coordinate movement backward
49	G_Detect	Recognition of the cartridge at the drive 0 = Pusher slightly under pressure, 1 = Pusher without pressure
50	G_GRP_DIS	Gripper position while pressing the Unload button 0 = 0°, Pusher slightly under pressure; 1 = 0°, Pusher under pressure; 2 = 7°, Pusher without pressure; 3 = 0°, Pusher without pressure
51	reserve	Reserve
52	reserve	Reserve
53	INIT	Must not be changed
54	X	X-coordinate global approach of the drive at main program
55	Y	Y-coordinate global approach of the drive at main program
56	Z	Z-coordinate global approach of the drive at main program
57	K	Angle of gripper while global approach of the drive at main program
58	W	Angle between drive and cover coordinate global approach of the drive at main program



### 9.9 Exchange of the gripper

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#### 9.9.1 Disassembly of the old gripper

---

- a) Shut down your system (**Shutdown AML**)
- b) Dismount the old gripper:
  - unscrew the plug-fixing-screws
  - unplug that plug
  - loosen the fixing of the air hose and pull off the hose
  - unscrew the 4 screw with an Allan key 4 mm

#### 9.9.2 Edit „KONFIG.DAT“

---

(☞ “Install new software and edit the parameters” from page 9 - 26)

#### 9.9.3 Assembly of the new gripper (parallel gripper)

---

- a) Mount the parallel gripper (= new gripper)
  - tighten the 4 screws with an Allan key 4 mm
  - mount the air hose
  - plug in the plug and screw it down with the fixing screws

#### 9.9.4 Teach your system

---

- a) Restart your system
- b) Determine the teach points with the PHG, position the pusher always as exact as possible onto the teach label
- c) Enter the values of **Teach Coordinates** on your PHG in **Graphical Configuration**
- d) Teach now all components via **MTCG dialog**.  
Duration: like systems without parallel gripper
- e) Test handling of all components with **Get** and **Put** commands
- f) Correct - only if necessary - the offset values in „KONFIG.DAT“ and offset values of the drives in the corresponding parameter files for these drives

### 9.9.5 Exchange parallel gripper - parallel gripper

Always replace the entire gripper.

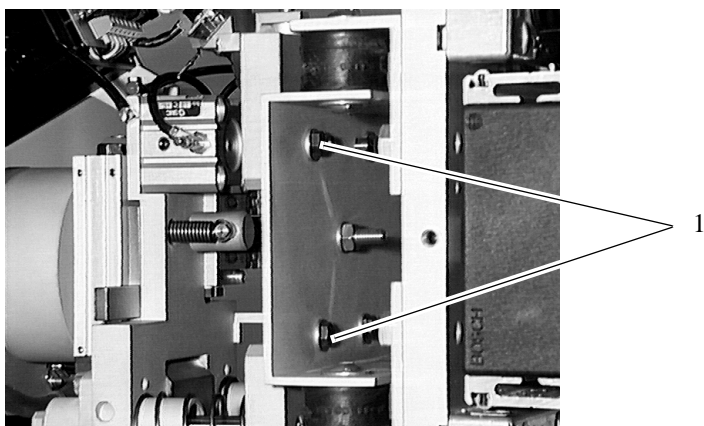


Fig. 9-25: Gripper Support

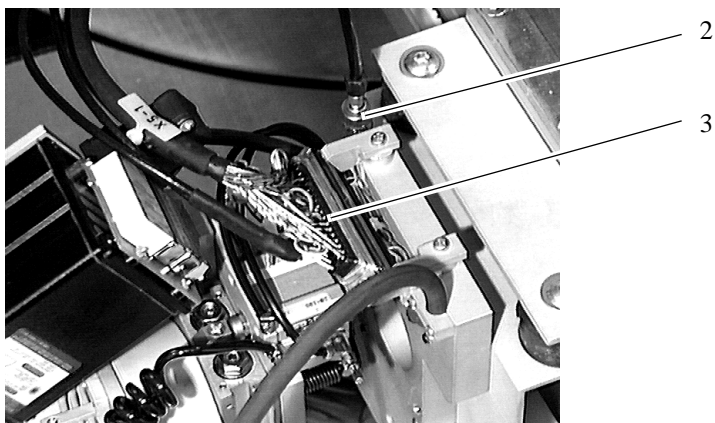


Fig. 9-26: Gripper Connections

### 9.9.6 Preparation

Change all parameters on the gripper data sheet in “KONFIG.DAT”:

- Call up the **Rho File Manager** (👉 AMU Reference Guide)
- Select **Receive from Rho**
- Select the partner (robot control system)
- Select the file “KONFIG.DAT”
- Select chosen target directory
- Click on **Start Receive**
- Open OS/2 window

- h) Change to chosen directory (cd ..)
- i) Open the file with the “EPM” editor (EPM KONFIG.DAT)

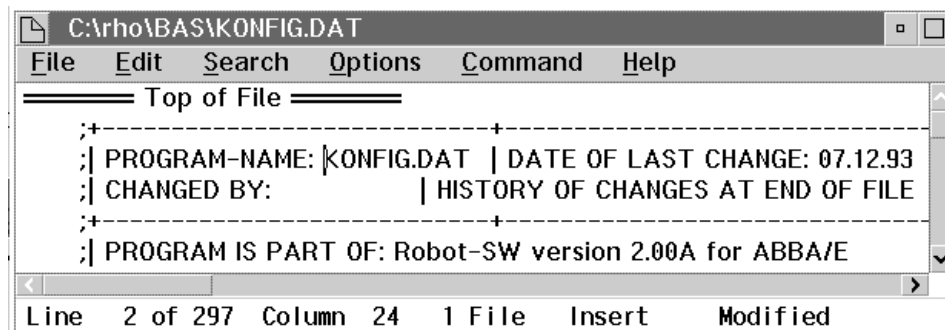


Fig. 9-27: Window OS/2-Editor EPM

- j) Enter data on the gripper data sheet into “KONFIG.DAT”



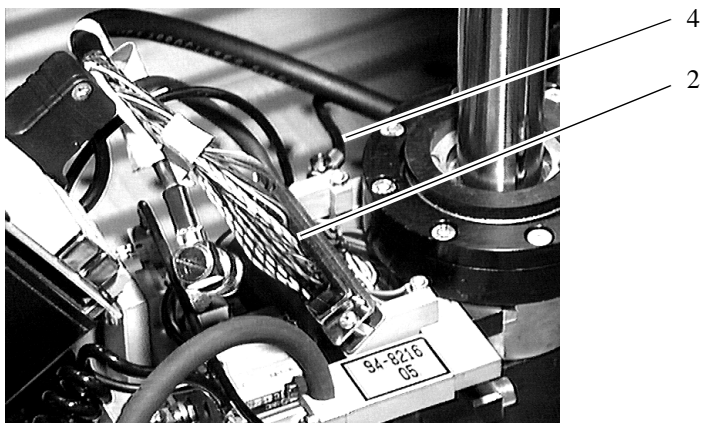
### Information

**Also enter the values on the parameter list!**

- k) Save the file
- l) Exit the editor
- m) Change to the **Rho File Manager**
- n) Select **Send to Rho**
- o) Select directory
- p) Select the file “KONFIG.DAT”
- q) Click on **Select**
- r) Click on **Start Send**
- s) Quit the **Rho File Manager**
- t) Press <CONTROL OFF>
- u) Switch off the main switch

### 9.9.7 Dismounting

- a) Remove the cover of the connections



*Fig. 9-28: Connection Gripper Cable on the Gripper (Barcode Scanner)*

- b) Unplug the cable
- gripper cable (2)
  - air hose (4)



#### ATTENTION

**The gripper can fall down.  
Hold the gripper while dismounting it.**

- c) Remove the fastening screws (1) on the rear of the gripper
- d) Horizontally pull the gripper from the locating bores

### 9.9.8 Mounting

reverse sequence



#### ATTENTION

**Be sure to care for correct and clean mounting of**

- the cable connection
- the air hose connection

**Protect cable and hose from unintentional disconnection.**



### Information

**Tightening torque for the fastening screws 5.5 Nm.**

### Test the gripper functions

- a) switch the main switch on and let the control system boot
- b) press <CONTROL ON>
- c) call up the test program: press ALT + SHIFT + <dead man>
- d) press 1 + <dead man> (Test)
- e) press 1 + <dead man> (installation)
- f) press 3 + <dead man> (gripper test)
- g) press 1 + <dead man> (gripper functions)
- h) check the gripper functions (☞ page 6 - 6)
  - proceed from one function to the next by pressing ↔
- i) quit the gripper test program by pressing 0
- j) quit installation by pressing 0
- k) quit the robot test program by pressing 9

### Test the Teach Facility

- a) Open the **Trace** window in the **View** menu
- b) Select **Online**
- c) Select **TraceID KRN8**

d) Reteach (🔍 page 5 - 6)

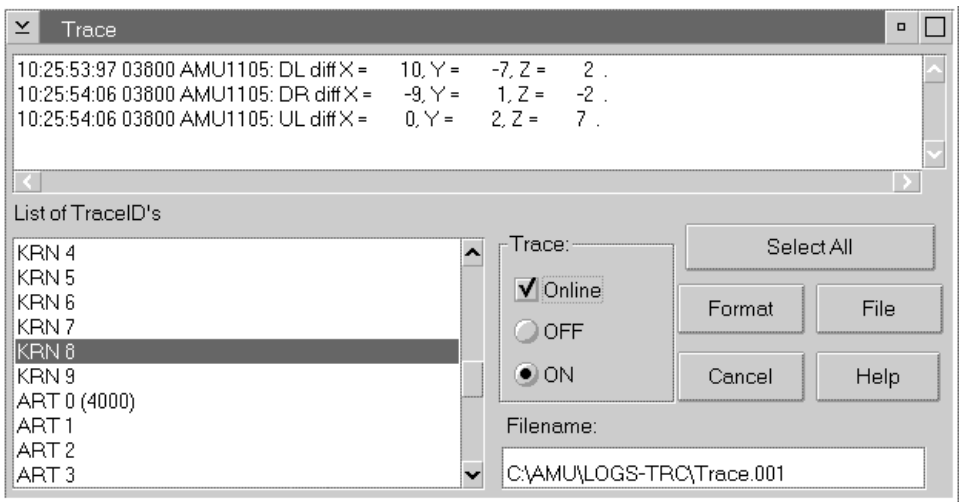


Fig. 9-29: Trace Window with KRN8

e) The **Trace** window displays the differences: if one of the offset values are > 60,  
- correct the values in the KONFIG.DAT

Direction	Parameter	Position	Sign
Y	G_Y_TEACH	154	opposite

- repeat teach procedure on a other segment
- if now the differnces < 60 reteach the first segment

Test the Handling

- a) Reduce the speed to 10 % (PHG Mode 11.4)
- press **MODE** , **1** , **1** (11), **↔** (help functions)
  - press **MODE** , **4** , **↔** (adjust VFACTOR)
  - press **0** , **.** , **1** (0.1), **↔**
- b) Test the AMU commands **Put** and **Get** on all units
- c) Check whether the gripper moves smoothly into and out of the compartments  
(does not bump into the edges of the compartment)
- d) If necessary correct the handling offset values in the file “KONFIG.DAT”

### Test the Barcode Read System

- a) Start the **Inventory** command
- b) Check whether the barcode is read immediately
- c) If necessary activate the special code types (default only Code 39 and STK)  
(☞ page 6 - 12)
- d) If necessary apply barcode optimization to the robot test program (☞ page 6 - 7)
- e) Reset the speed to “1”

### Software Backup

- a) Copy the changed KONFIG.DAT on the floppy robot & tower software.
- b) Fill in the changed parameter(s) in list of the „Software Backup“

### 9.9.9 Adjust the Reference Point

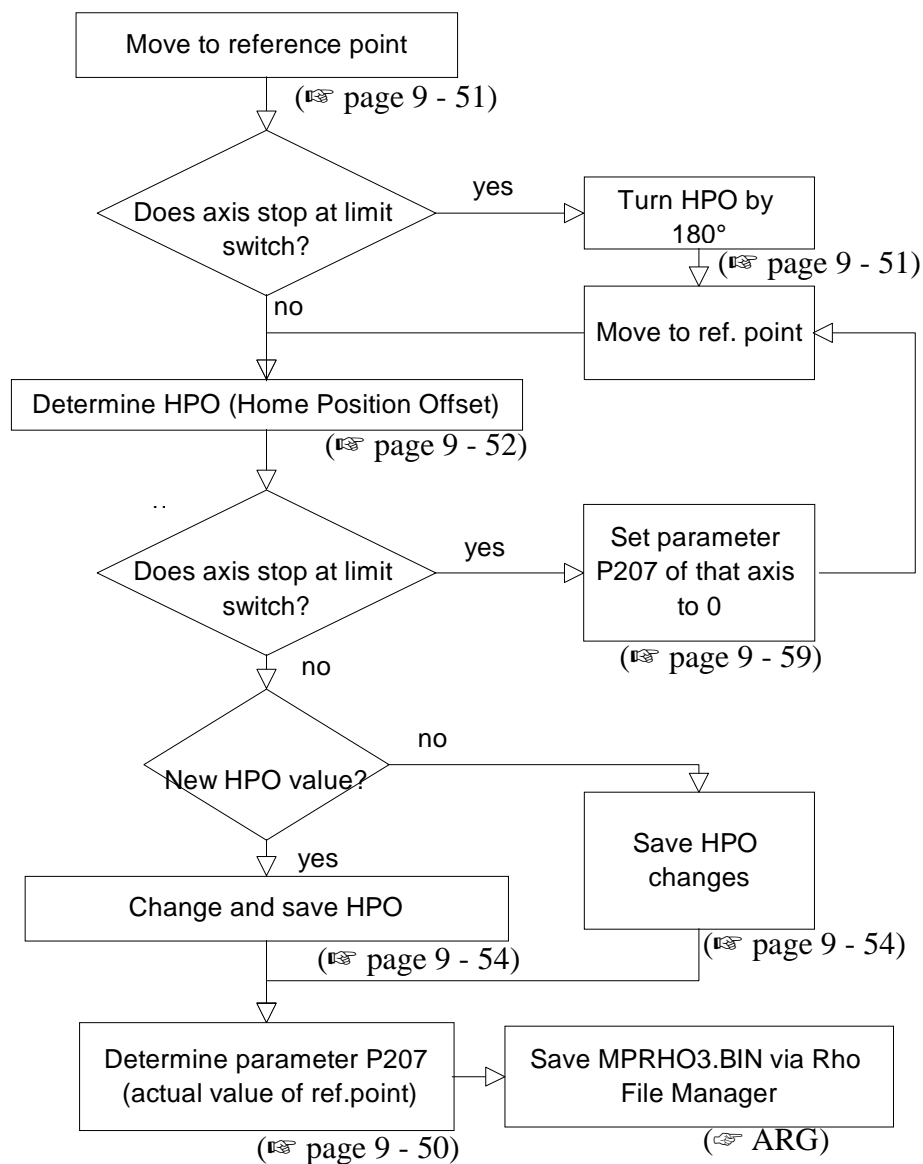


Fig. 9-30: Calculation of reference point parameters



### Move to Reference Point

- a) Switch on the main switch
- b) Let the control system run up



### Information

**During reference movement the changed axis could stop on the limit switch. Then make a change of the HPO value by 180°. Otherwise (☞ “Measure HPO (Home Position Offset)” from page 9 - 52)**

- c) Press <CONTROL ON>. The robot makes a reference movement

### Change HPO 180°

- a) Open the AMU OS/2 window
- b) Change to drive cd C\ (C :)
- c) Change to directory “C:\MOOG” (cd moog)
- d) Call up the communication program “BOSCHTRM” (boschtrm)
- e) Enter <C> for „Configure“
- f) Adjust the configuration
  - Communication Mode RS 232 <1>
  - Communication Port COM1 <1>
  - COM2 <2>
  - Interface type IQ140/RHO3 CAN <2>
  - Helpfile IQ 140/RHO <2>
- g) Press <ENTER> and wait until the following message appears:

---

```
Enter first
letter of a
command or H
for help >                                input: <SHIFT>+<*>
```

---

```
Privileged
Mode
(Y/N) >>                                input: <Y>
```

---






```
Password ?
OK!                                       input: <7>, <8>, <2>, <3>
```

Enter first letter of a command or H for help >	input: <o>, <o> (letter)
Home Position Offset [Deg] 12 -more-	input: <ENTER>
Offset [Deg] 0 - 360 ?	input: old value changed about 180°(+ or -), <ENTER>


- h) Reset rho
- i) Let the control system run up.  
Press <CONTROL ON>  
The robot makes a reference movement

### Measure HPO (Home Position Offset)


This procedure finds the offset between the reference point switch and the zero mark of the motor measuring system after mechanic alterations of the drive system.

- a) Call up the test program by pressing  +  + <dead man>
- press  + <dead man> (TEST)
  - press  + <dead man> (installation)
  - press  + <dead man> (Homepos. Offset)

Home Position Offset  
  
 0 Cancel  
 More with Enter

input: 

Move all axis to Pos  
 0 (with Totman)  
 0 Cancel  
 More with ENTER


input:  + <dead man>

## Exchange of the gripper


---

Measuring HPO  
?. Axis  
0 Next Axis  
More with Enter


Go to the next axis with **0**


Select the axis with  .

Input of the actual  
Parameter P207 of  
the .axis


Press  .

Input the actual  
Home Position Offset  
of the n.Axis

Enter the current HPO value and confirm by  
pressing 

( „Software Backup, Parameters of Robot  
Amplifier“ or boschtrm program)


HPO Motor value of  
the .Axis Measure  
0 Cancel  
More with Enter

input: 

New Values ?. Axis  
HPO: ???  
P207: ???  
More with ENTER

Display of measured values.

Note deviating values.

input: 

b) Quit the menu by pressing **0**

c) Quit the test program

## Adopt and Save HPO changes



### Information

**If the communication program is still activated, then continue with step h).**

**Start terminal program („BOSCHTRM“ or „terminal“) only, if it's not already running.**

- a) Plug in the installation cable: AMU (COM1 or COM2)
- b) Plug in the installation cable: drive amplifier (X6)
- c) Open the AMU OS/2 window
- d) Change to drive cd C\ (C:) and to directory "C:\MOOG" (cd moog)
- e) Call up the communication program "BOSCHTRM" (boschtrm)
- f) Enter <C> for „Configure“
- g) Adjust the configuration
  - Communication Mode RS 232 <1>
  - Communication Port COM1 <1>
  - COM2 <2>
  - Interface type IQ140/RHO3 CAN <2>
  - Helpfile IQ 140/RHO <2>
- h) Press <ENTER> until the following message appears:

Enter first letter of a command or H for help >	input: <SHIFT>+<*>
Privileged Mode (Y/N) >>	input: <Y>
Password ? OK!	input: <7>, <8>, <2>, <3>
Enter first letter of a command or H for help >	input: <o>, <o> (letter)
Home Position Offset [Deg] 12 -more-	input: <ENTER>

## Exchange of the gripper

---

Offset [Deg] 0 - 360 ?	input: noted value, if it deviates, <ENTER>
Enter first letter of a command or H for help >	input: <C>
Sure (Y/N)?	input: <Y>
EEPROM ID ?	input: number of axis, <ENTER>
Wait-	
Saving Defaults Gaints in EEPROM	input: <ESC>,<Y> ,



### Determine Parameter P207

- a) Reset the control unit: press <Reset> on the power supply PS75 in the robot cabinet.
- b) Press <CONTROL ON>  
The robot makes a reference movement
- c) When the axis 3 will be adjusted (☞ “Reference point axis 3” from page 9 - 57)



### Information

**Push all axes manually to their reference positions, except axis 3!**

- d) press <CONTROL OFF>
- e) display the axis positions on the PHG (PHG Mode 7.1)
  - press **MODE** ; press **7** ; press  (diagnosis)
  - press **MODE** ; press **1** ;  (axis display)

### Reference point axis 1



*Fig. 9-31: Reference Marks on Axis 1*

- a) move axis 1 manually to the reference point
- b) the edge of the support bearing (1) must match with the mark (2)
- c) note down the PHG value displayed

### Reference point axis 2



Fig. 9-32: Reference Marks on Axis 2

- a) move axis 2 manually to the reference point
- b) the edge of the carriage (1) must match with the mark on the carriage guide (2)
- c) note down the PHG value displayed

### Reference point axis 3



Fig. 9-33: Reference Marks on Axis 3



#### **WARNING!**

#### **Risk of injury!**

**Move axis 3 with the PHG only when you stand outside the archive.  
Watch the movements from the window in the archive access.**

- a) call up the test program: press **ALT** + **SHIFT** + <dead man>
- b) press **1** + <dead man> (test)

- c) press 2 + <dead man> (move axis)
- d) press 1 + <dead man> (move robot)
- e) press 1 + <dead man> (world coordinates)
- f) enter speed (e. g. 10) and confirm by pressing ↵
- g) the edge of the carriage (2) must match with the mark on the column (1)  
if the mark does not match
  - make it match in manual operation
  - note down the PHG value displayed
- h) Quit the test program
  - 3 times press 0 + <dead man>
  - press 9 + <dead man>
  - press 0
- i) press <CONTROL OFF>

### Reference point axis 4

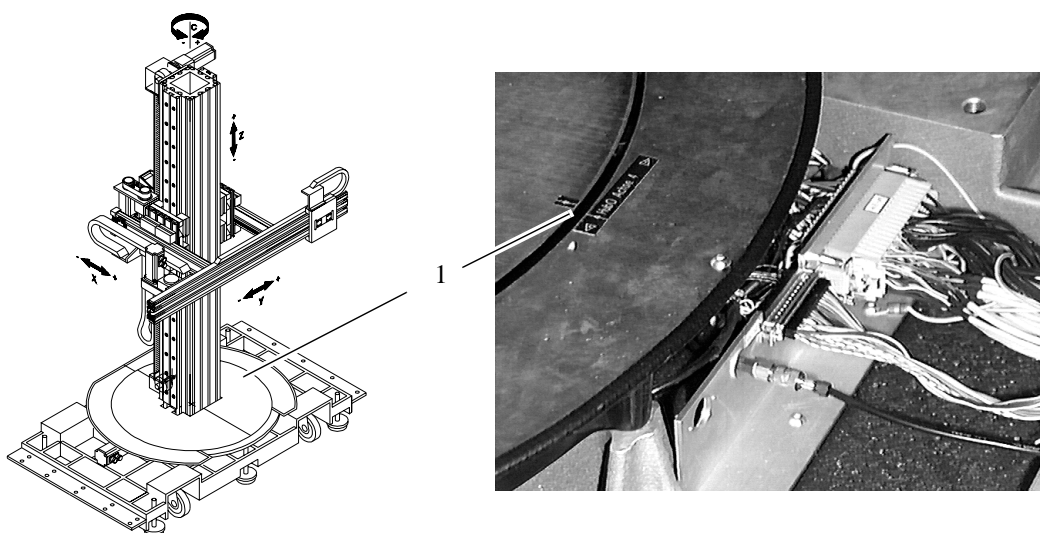
















Fig. 9-34: Reference Marks on Axis 4

- a) turn axis 4 manually to the reference point
- b) the marks (1) must match
- c) note down the PHG value displayed



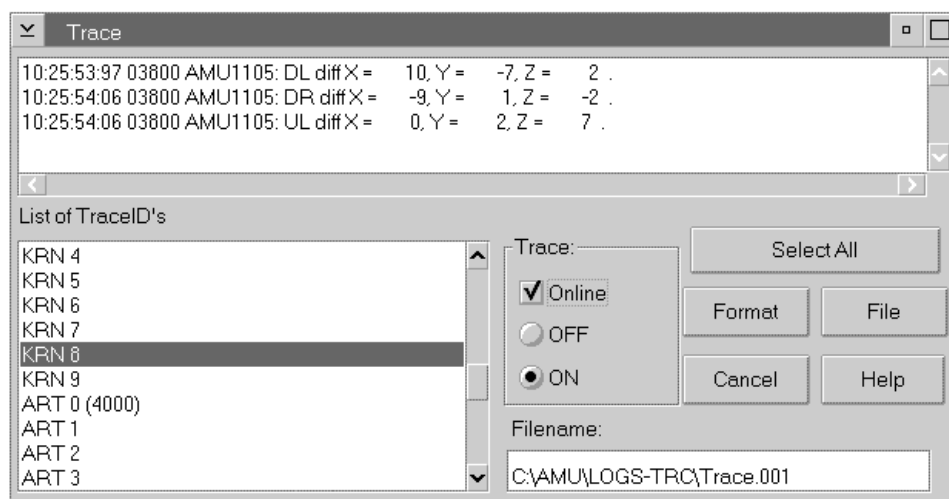
### Enter the machine parameters

- a) Press <CONTROL OFF>
- b) One after the other press , ,  (diagnosis)
- c) One after the other press , ,  (machine parameters)
- d) One after the other press , ,  (set machine parameters)
- e) Set parameters: enter the number and confirm with 
- f) Press  until the axis number is in the display
  - P205: check the negative software limit switch if changed axis 3 is at „-1“
  - P207: adjust the reference point actual value of the axis with the **opposite** sign of the value noted down
  - P208: adjust the reference point offset noted down for the axis with the PHG value
    - axes 1, 3, 4: noted value (negative P207)
    - axis 2: noted value + 600 (for gripper middle position)
- g) Complete the input with 
- h) Write the input to the EEPROM with 
- i) Confirm the safety prompt with 

An automatic reset is called
- j) Let the control system run up
- k) Press <CONTROL ON>.  
The robot makes a reference movement

**Teach with trace “KRN8”**

- a) Open the **Trace** window in the **View** menu
- b) Select **Online**
- c) Select **TraceID KRN8**
- d) Reteach (☞ page 5 - 6)



*Fig. 9-35: Trace Window with KRN8*

- e) The **Trace** window displays the differences: if the offset values are > 100, correct the values in Parameter P207 and on the datasheet
- f) Check the reference point offset, repeat the procedure if required
- g) Save the file “MPRHO3.BIN” with the **Rho File Manager**
- h) Fill all changed values in the list „Software Backup“
  - Home Position Offset
  - Reference point

9.10 I/O Unit/B

9.10.1 Overview

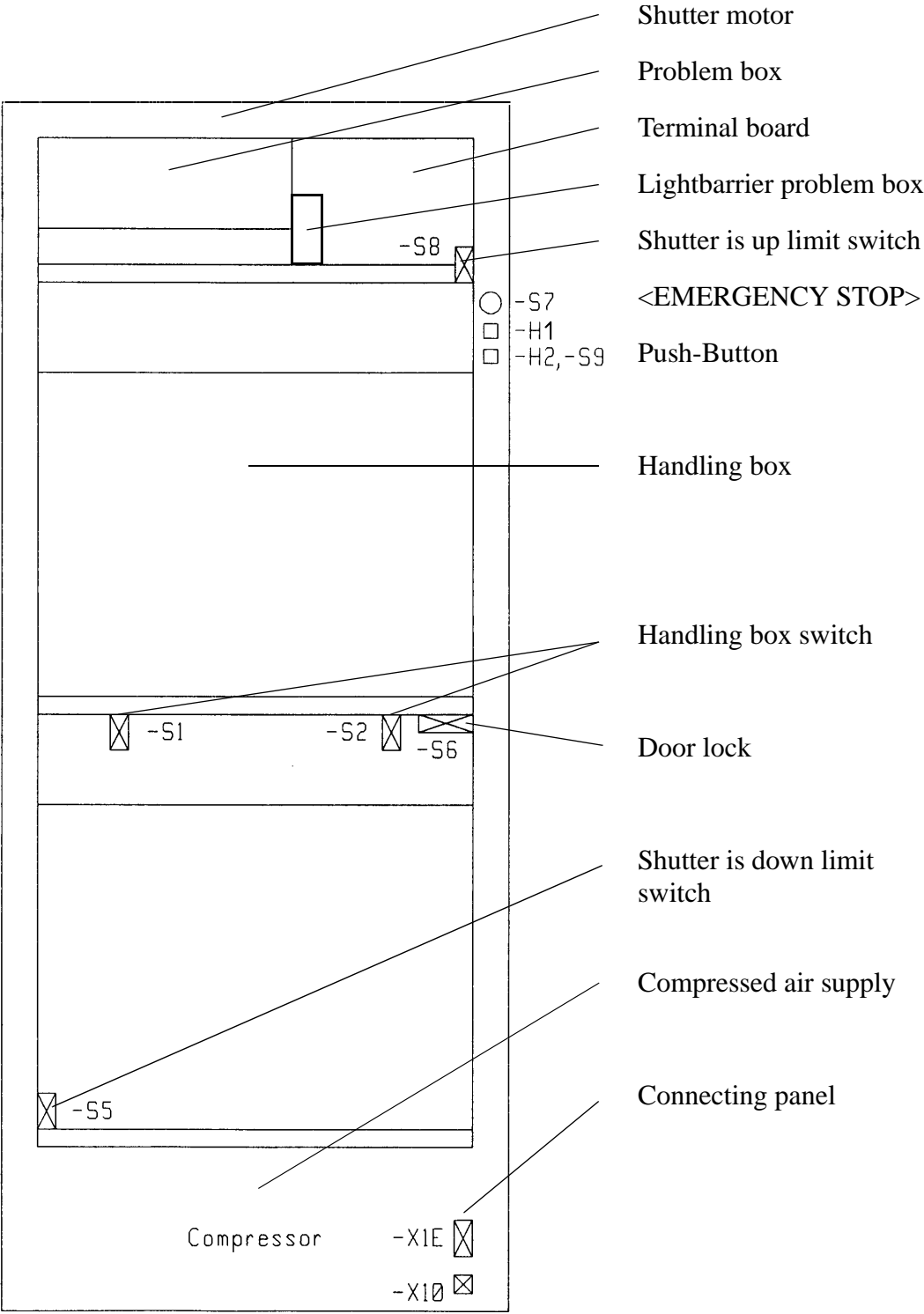


Fig. 9-36: I/O Unit/B Overview

### 9.10.2 Connecting Panel

Position: on the bottom inside the I/O unit, behind the cover (☞ page 9 - 61)

- X1E: connecting plug
- X10: 230 V supply voltage for compressor

pin configuration (☞ electric diagram)

### 9.10.3 Shutter is Up Limit Switch

S8 inside the I/O unit (☞ page 9 - 61)

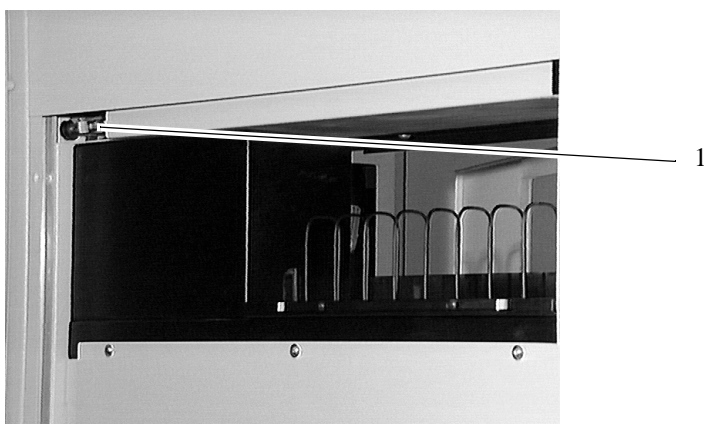


Fig. 9-37: I/O Unit/B Problem Box Seen from Inside

#### Dismounting

- a) Dismount the shutter (☞ page 9 - 64)
- b) Dismount the limit switch
- c) Disconnect the limit switch

#### Mounting



#### ATTENTION

**During operation the cam pulley must run above the shutter cam.**

in opposite sequence

### 9.10.4 Shutter is Down Limit Switch

---

S6 inside the I/O unit (☞ page 9 - 61)

#### **Dismounting**

- a) Dismount the two cover plates
- b) Mark the position of the support plate
- c) Dismount the switch with the support plate
- d) Separate the switch from the support plate
- e) Disconnect the cable

#### **Mounting**

- a) Insert cable and connect it
- b) Mount the switch to the support plate
- c) Align the support plate with the marks and screw it
- d) Mount the two cover plates

### 9.10.5 Shutter with Motor

---

on top inside the I/O unit (🔍 page 9 - 61)

#### **Dismounting**

- a) Open the I/O door
- b) Open the terminal box
- c) Disconnect the shutter drive motor
- d) Remove inside cover above the shutter
- e) Dismount the shutter cover
- f) Loosen the seven fastening screws from the top of the I/O unit
- g) Pull the shutter out

#### **Mounting**

- a) Insert the cable into the terminal box
- b) Mount the shutter
- c) Tighten the fastening screws
- d) Mount the shutter cover
- e) Mount the cover
- f) Connect the shutter drive motor inside the terminal box

### 9.10.6 Push-Button

---

H1, H2/S9 on the left side of the I/O unit (🔍 page 9 - 61)

#### **Dismounting and Mounting**

- a) Dismount the support plate
- b) Continue with (🔍 “Push-Button” from page 10 - 5)

### 9.10.7 <EMERGENCY STOP> Button

---

S7 on the left side of the I/O unit (🔍 page 9 - 61)

#### **Dismounting**

- a) Dismount the support plate
- b) Unlock plug catch by turning the plug
- c) Dismount the switch insert

#### **Mounting**

- a) Mount the switch insert
- b) Plug in the plug
- c) Mount the support plate

### 9.10.8 Door Lock

---

S6 on the right side of the I/O unit (🔍 page 9 - 61)

#### **Dismounting**

- a) Dismount the two cover plates
- b) Dismount the door lock
- c) Disconnect the door lock (note down the terminal connection)

#### **Mounting**

- a) Connect the door lock (observe correct terminal connection)
- b) Mount the door lock
- c) Mount the two cover plates
- d) Check the function

### 9.10.9 Lightbarrier for Problem Box

inside the terminal box, next to the problem box (☞ page 9 - 61)

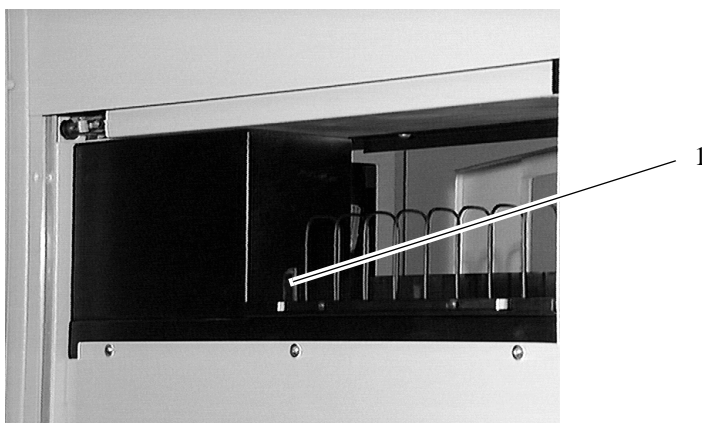


Fig. 9-38: I/O Unit/B Problem Box Seen from Inside

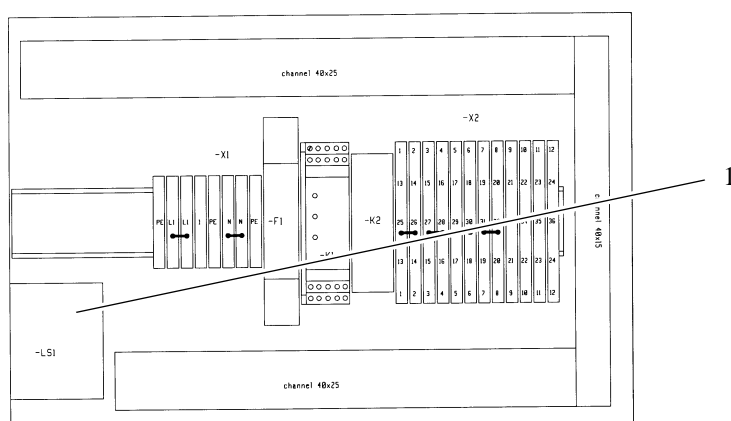


Fig. 9-39: I/O Unit/B Terminal Box

#### Dismounting

- Open the I/O door
- Open the terminal box
- Unplug the lightbarrier
- Dismount the support bracket of the lightbarrier
- Separate the lightbarrier from the support bracket

#### Mounting

in opposite sequence

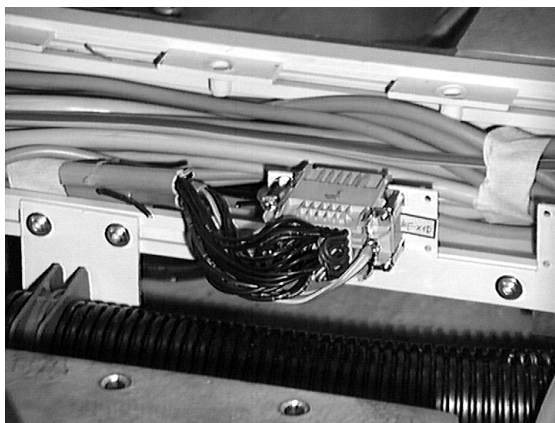


### 9.11 Hexa Tower

---

#### 9.11.1 Connecting Panel

---



*Fig. 9-40: Hexa Tower Connecting Panel*

pin configuration (🔗 electric diagram)

#### 9.11.2 Motor and Gears

---

Motor and gears are exclusively replaced by ADIC/GRAU Storage Systems GmbH.

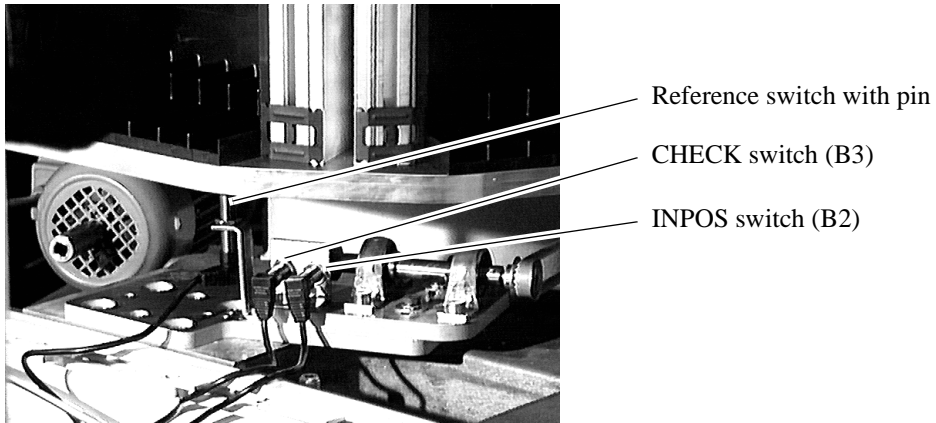
#### 9.11.3 Storage Box

---

(🔗 “Storage Box” from page 9 - 78)

#### 9.11.4 Reference and Position Switches

below the turning tower



*Fig. 9-41: Reference and Position Switches on Hexa Tower*

#### Dismounting

- a) Position the Hexa tower
  - reference switch opposite the pin (distance 1 mm)
  - position switch with 1 mm distance to the cam slide
- b) Unplug and dismount the switch

#### Mounting

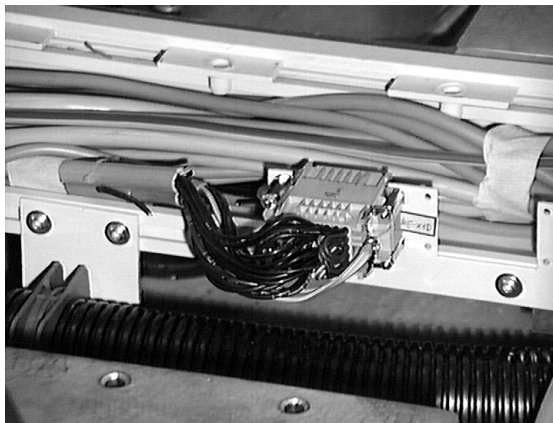
- a) Mount the switch
  - distance of the switch to the cam slide or to the pin: 1 mm
- b) Plug in the switch

### 9.12 Quadro Tower

---

#### 9.12.1 Connecting Panel

---



*Fig. 9-42: Quadro Tower Connecting Panel*  
pin configuration (👉 electric diagram)

### 9.12.2 Main and Auxiliary Tower Drive-Motors

behind the cover doors of the Quadro tower

- left: main tower drive-motor
- right: auxiliary tower drive-motor



*Fig. 9-43: Main Tower Drive-Motor*



*Fig. 9-44: Auxiliary Tower Drive-Motor*

### Dismounting

- a) Open the cover door
- b) Pull the motor plugs (1)
- c) Loosen the motor screws (3)
- d) Dismount the motor (2)

### Mounting

- a) Carefully insert the motor



### Information

**Slowly turn the motor until the spline shaft settles.**

- b) Insert motor screws and washers
- c) Push earthwire (4) under a washer
- d) Tighten motor screws crosswise with 45 Nm
- e) Connect motor plugs
- f) Close the cover door

### 9.12.3 Main and Auxiliary Tower Gears

#### Preparation

Position Quadro tower to align the cam with the reference switch (☞ page 9 - 77).

#### Position

behind the cover doors of the Quadro towers

- left: main tower gears
- right: auxiliary tower gears

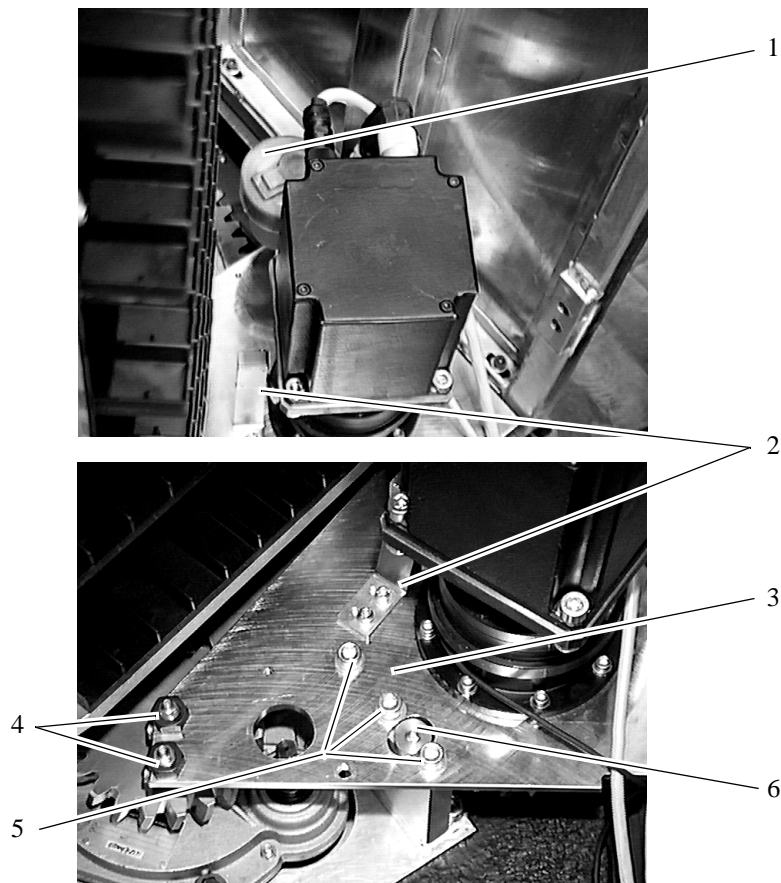


Fig. 9-45: Auxiliary Tower Drive-Unit

### Dismounting

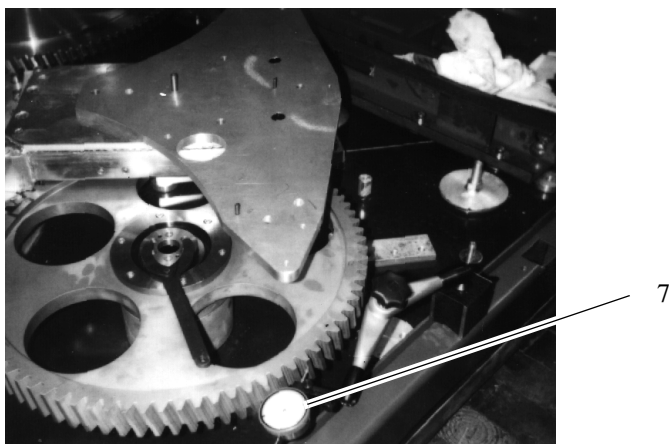
- a) Dismount the motor (☞ page 9 - 70)
- b) Dismount the grease nipple (4)
- c) Unscrew the lubricating cartridge (1)
- d) Dismount the connection of the lubricating cartridge
- e) Measure and note down the distance of reference switch (2) and the cam
- f) Dismount the reference switch and the bracket (2)
- g) Dismount the base plate (3)
- h) Loosen and remove the fastening screws (5)
- i) Dismount the drive gear from the drive shaft
- j) Dismount the gears from the base plate

### Mounting

- a) Mount the gears to the base plate
  - tightening torque 10 Nm
- b) Mount the drive gear to the drive shaft
- c) Mount the base plate (3)
- d) Lightly tighten the screws (5)
- e) Adjust the play of the tooth profile with the eccenter (6)



*Fig. 9-46: Play of the Tooth Profile on the Main Tower*



*Fig. 9-47: Play of Tooth Profile on Auxiliary Tower*

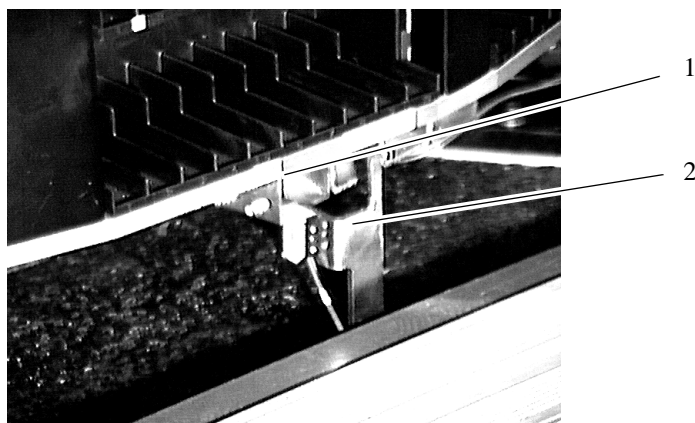
- f) Adjust the base plate until no play can be detected anymore
  - apply a dial gauge (resolution 0.01 mm) to the frame of the Quadro tower
  - apply the caliper of the dial gauge (7) to one tooth on the drive gear
  - adjust the play of the tooth profile to 0.05 mm
- g) Tighten the fastening screws (5) with 20 Nm
- h) Check the play of the tooth profile, readjust if necessary
- i) Mount the reference switch and the bracket (2)
  - adjust the distance to the cam
- j) Mount:
  - the connection of the lubricating cartridge
  - the lubricating cartridge
  - the grease nipple
- k) Mount the motor (➤ page 9 - 70)
- l) Teach the Quadro tower (➤ page 5 - 6)



### 9.12.4 Main Tower Reference Switch

---

center of the Quadro tower below the lower cover plate



*Fig. 9-48: Main Tower Reference Switch*

#### **Preparation**

Position Quadro tower to align the cam (1) with the reference switch (2).

#### **Dismounting**

- a) Measure and note down the distances
  - distance to the cam (1): 2 mm
  - position relative to the cam
- b) Dismount and disconnect the reference switch (2)

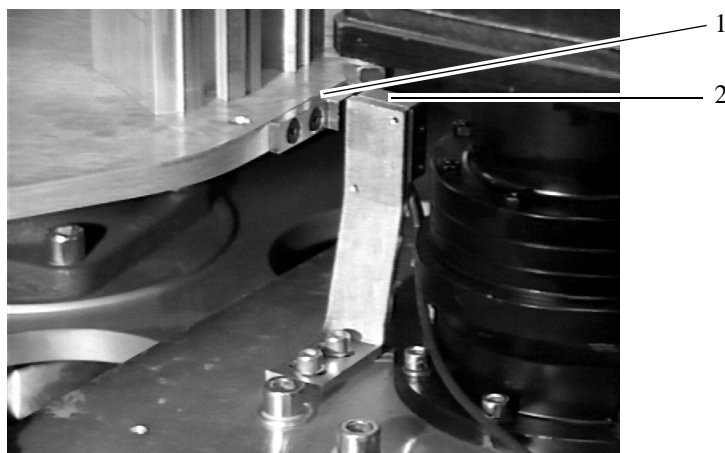
### Mounting

- a) Connect and mount the reference switch
- b) Adjust the reference switch
  - distance to the cam: 2 mm
  - position relative to the cam
- c) Check the function
- d) Check parallelity of Quadro tower and handling unit and correct it if necessary
  - switch the main switch on and let the control unit boot
  - press <CONTROL ON>, wait until the end of the reference movements
  - continue with “Offset Quadro tower” (➡ page 6 - 4)
  - save changed file “TKONFIG.DAT” with the Rho File Manager (➡ ARG)
- e) Teach Quadro tower (➡ page 5 - 6)

### 9.12.5 Auxiliary Tower Reference Switch

---

behind the right cover door of the Quadro tower next to the motor



*Fig. 9-49: Auxiliary Tower Reference Switch*

#### Preparation

Position Quadro tower to align the cam (1) with the reference switch (2).

#### Dismounting

- a) Measure and note down the distances
  - distance to the cam (1): 2 mm
  - position relative to the cam
- b) Dismount and disconnect the reference switch (2)

#### Mounting

- a) connect and mount the reference switch
- b) adjust the reference switch
  - distance to the cam: 2 mm
  - position relative to the cam
- c) check the function
- d) teach the Quadro tower (☞ page 5 - 6)

## 9.12.6 Storage Box

### Position

inside storage tower

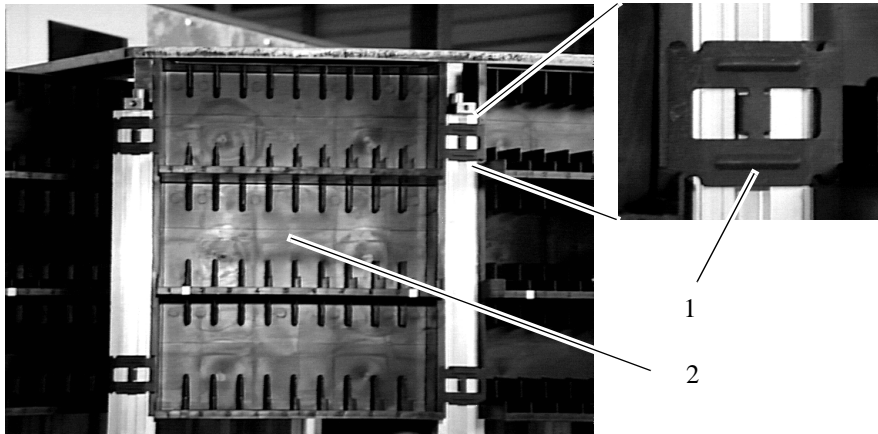


Fig. 9-50: Storage Box

### Dismounting

- a) Dismount cover plates



### Information

**The cover plates are screwed to the base plate from underneath.**

- b) Remove clamping plates (1)



### ATTENTION!

**Remember the sequence of the storage boxes.  
All media must be replaced to the same positions!**

- c) Remove the storage boxes (2) from the top

### Mounting



#### ATTENTION!

##### Do not mix up

- the positions of the individual media
- **the storage boxes (with or without teach labels)**
- put the individual media into the new storage box
- insert the new storage box



#### ATTENTION!

##### Observe the sequence of the storage boxes!

- a) Insert the other storage boxes
- b) Mount the clamping plates
- c) Mount the cover plates
- d) Teach the tower segment (👉 page 5 - 6)



# 10 Repairs on the Control Unit

---

## 10.1 For Your Safety

---

According to German accident prevention rules and standards VBG 4, VDE 0105 and VDI 2853 repair work must be carried out exclusively by trained personnel.

A precondition is knowledge of the safety rules for work on electrotechnical equipment.



### **WARNING!**

**During all work observe the safety rules in chapter 3 “For Your Safety” (📖 page 3 - 1).**

## 10.2 Preparations

---



### **WARNING!**

**All repair work must be carried out only when the system is switched off and voltageless.**

**The main switch and the push-button <SYSTEM LIGHTING> are live even when the main switch is switched off. Before working on these components pull the plug X1B on the bottom left inside the control cabinet (📖 page 10 - 42).**

**Before working on other components shut off power with the main switch and secure it with a padlock.**

**Guard the key in a safe place or keep it with you.**

**Shut the AML/E system off before (📖 Operator Guide)**

**Apply the warning sign (📖 page 3 - 12).**

## 10.3 Putting Back into Service

---



**WARNING!**

Before starting the AML/E system be sure the start will not

- endanger people,
- damage property.

Start the AML/E system (➡ Operator Guide).



### 10.4 Control Unit

#### 10.4.1 Overview

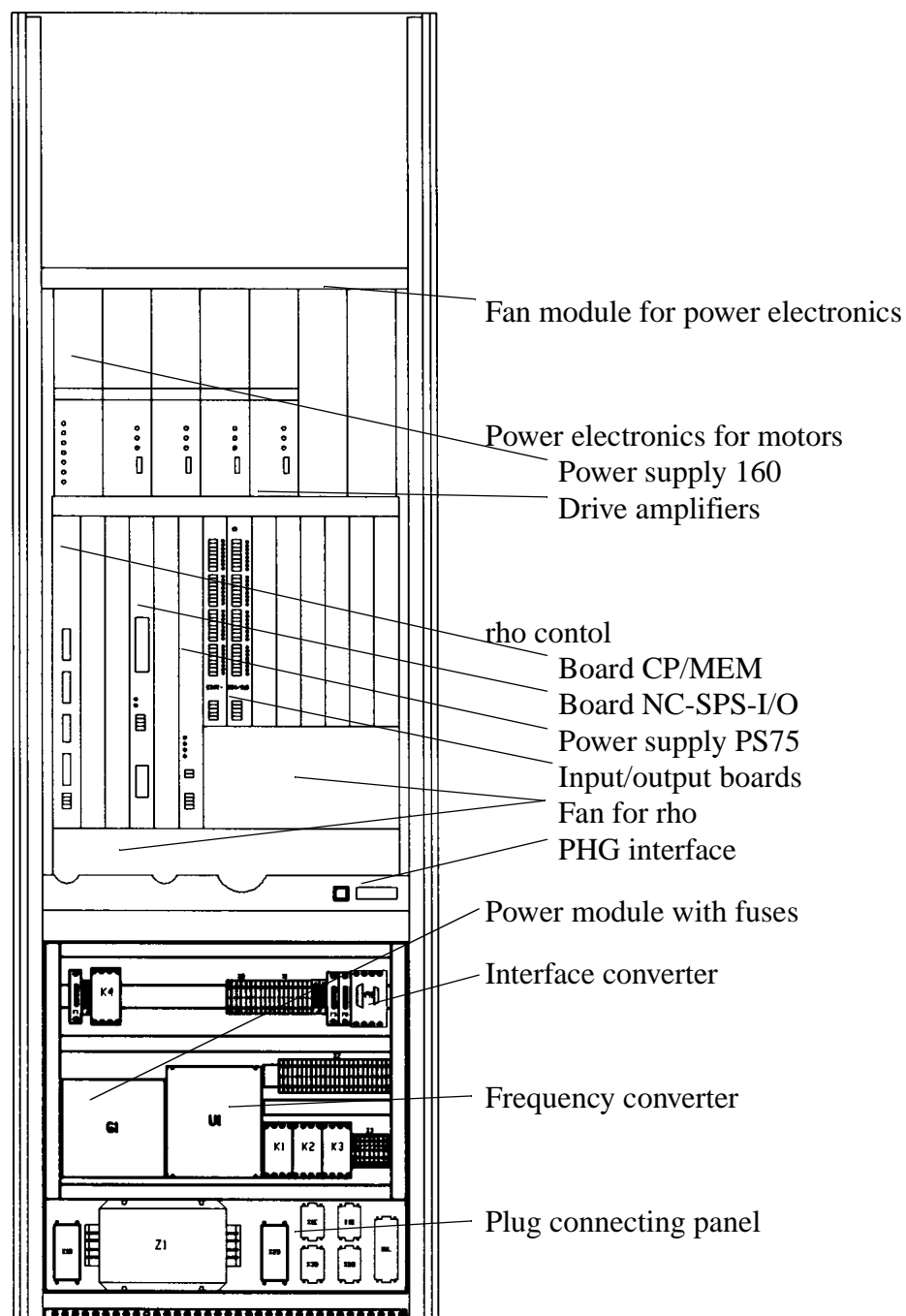
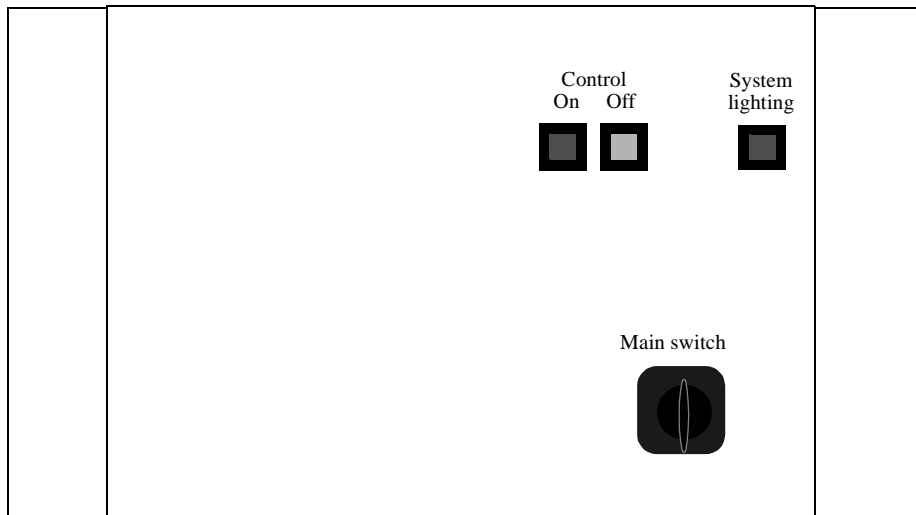


Fig. 10-1: Inside View of Control Unit

### 10.4.2 Main Switch

on the AML/E control unit door (☞ see figure above)



*Fig. 10-2: AML/E Control Unit Door*

#### Dismounting

- Disconnect the main switch from power (plug X1B)
- Secure disconnected plug
- Disconnect contacts by turning them (rear)
- Unscrew the screw in the center of the switch (front)
- Remove knob and cover plate
- Loosen nut
- Pull off the switch to the rear

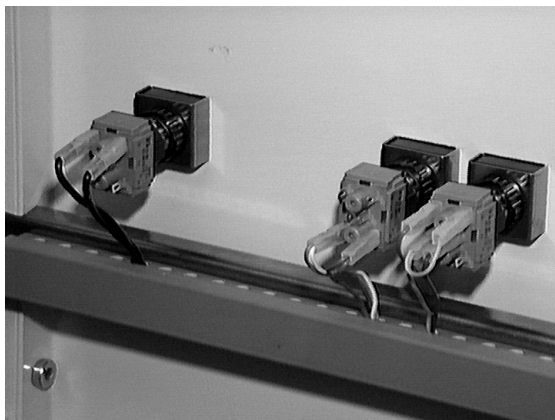
#### Mounting

in opposite sequence

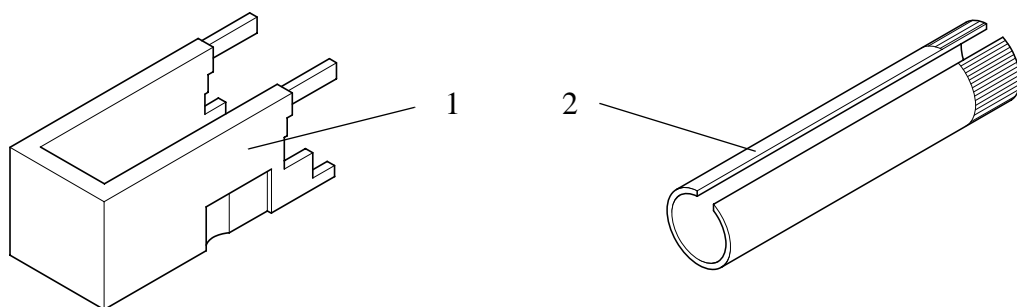
### 10.4.3 Push-Button

---

on the AML/E control unit door



*Fig. 10-3: AML/E Control Unit Door Seen from Inside*



*Fig. 10-4: Dismounting Tool (1) and Assembly Key (2)*

#### **Dismounting**

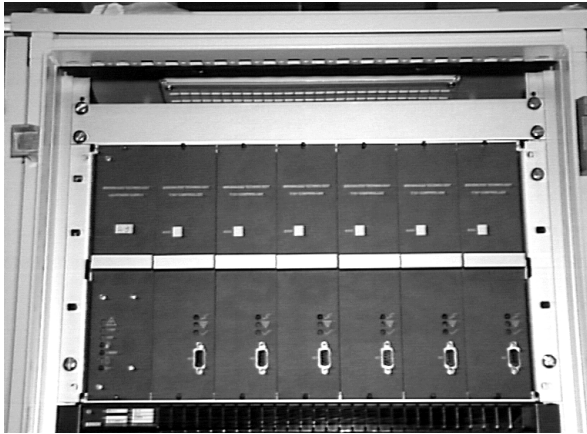
- a) Disconnect the contacts
- b) Pull off the contact block with the dismounting tool (1)
- c) Loosen the locking ring with the assembly key (2)
- d) Remove the switch inserts

#### **Mounting**

in opposite sequence

#### 10.4.4 19" Rack for Drive Amplifiers

on top inside the control unit



*Fig. 10-5: 19" Rack Drive Amplifiers*

#### Dismounting

- a) Switch off the main switch
- b) Remove all boards
  - mark the boards and note down their positions
  - loosen the fastening screws of the boards
  - unplug the boards
- c) Loosen the fastening screws of the fan module
- d) Pull out the fan module and put it aside
- e) Remove side wall of control cabinet
- f) Unplug all cables on the 19" rack
- g) Loosen the fastening screws of the 19" rack
- h) Dismount the 19" rack

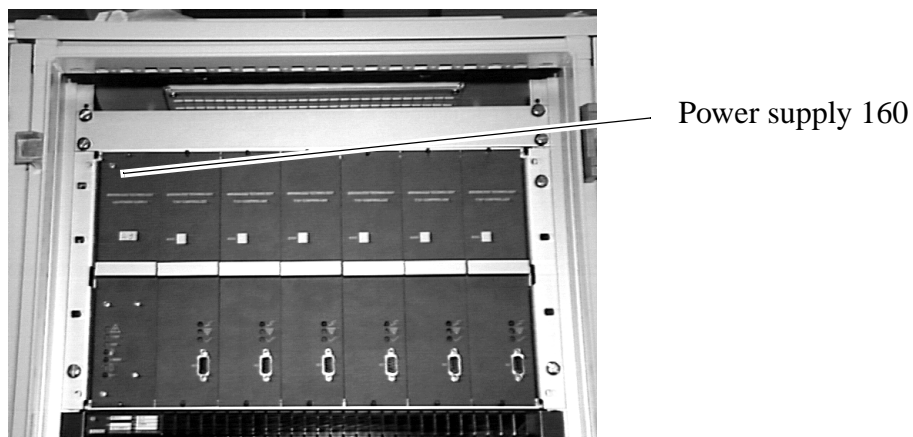
#### Mounting

in opposite sequence

### 10.4.5 Power Supply 160 for the Drive Amplifiers

---

on top inside the control unit (☞ page 10 - 3)



*Fig. 10-6: Robot Amplifier Front*

#### **Dismounting**

- a) Switch off the main switch
- b) Disconnect the connectors
- c) Loosen the fastening screws
- d) Unplug the board

## Mounting



### ATTENTION!

Note the position of the load resistor plug. The internal load resistance (below the plug) is not sufficient for the motors used..

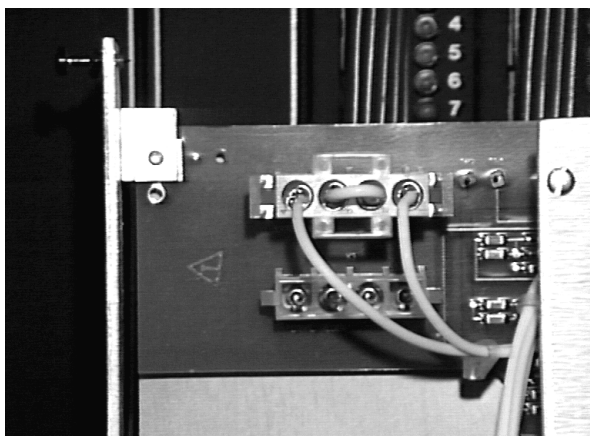


Fig. 10-7: Power Supply 160: Load Resistor Plug

**Plug the plug in at the top position (external).**

a) Configure the board

- plug the load resistor plug into “Extended Regeneration”
- do not plug the jumper JW1 into “E”  
(3-phase failure monitoring not activated)

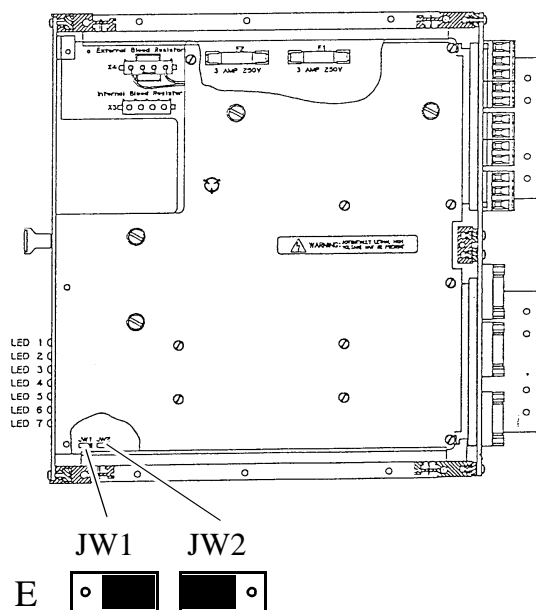


Fig. 10-8: Power Supply for Amplifiers: Jumper

b) Plug in the board

- c) Tighten the fastening screws

### 10.4.6 Position of Drive Amplifiers

on top, inside the control unit (☞ page 10 - 3)

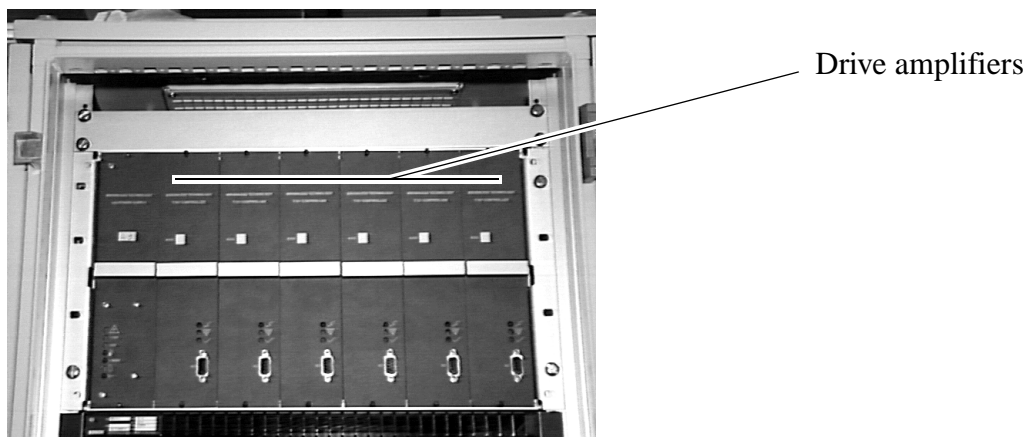


Fig. 10-9: Drive Amplifiers Front

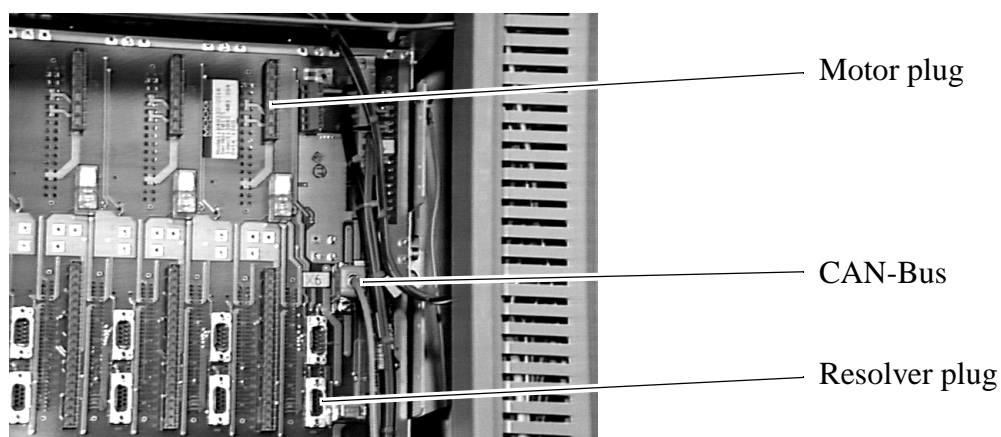


Fig. 10-10: Drive Amplifier Rear

### Check the actual HPO parameter

#### Connect AMU to the board

- Switch on the main switch
- Connect the installation cable to the AMU interface COM1 or COM2 (if necessary disconnect another cable)
- Connect the installation cable to the drive amplifier socket X6
- Open AMU OS/2 window



- e) Change to directory "C:\MOOG" (cd moog)
- f) Call up the communication program "BOSCHTRM" (boschtrm)
- g) Enter <C> for „Configure“
- h) Adjust the configuration
  - Communication Mode RS 232 <1>
  - Communication Port COM1 <1>
  - COM2 <2>
  - Interface type IQ 140/RHO3 <2>
  - Help file IQ 140/RHO3 <2>
- i) Press <ENTER> until the following message appears:

---

Enter first  
letter of a  
command or H  
for help > input: <SHIFT>+<\*>

---

Privileged  
Mode  
(Y/N) >> input: <Y>

---

Password ?  
OK! input: <7>, <8>, <2>, <3>

---

Enter first  
letter of a  
command or H  
for help > input: <o>, <o> (letter)

---

Home Position  
Offset [Deg]  
12  
-more- input: <ENTER>

---

Offset [Deg] compare value with the parameter  
in the software backup (write  
actual value in the software bak-  
kup) <ENTER>

0 - 360  
?

### Dismounting

- a) Switch off the main switch
- b) Unplug the connectors
- c) Loosen the fastening screws
- d) Unplug the board

### 10.4.7 Amplifier Series T 161 - 6xx

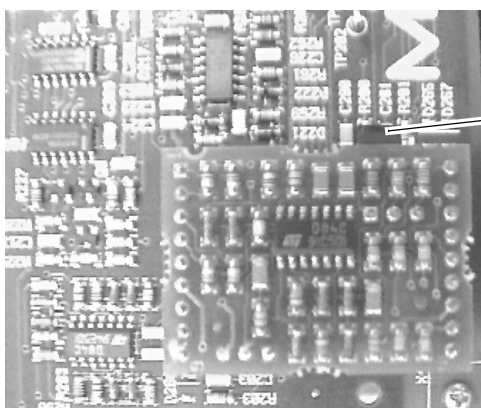
#### Mounting.

Axis	Motor	Drive Amplifier			Jumper Position MCO
		Type	Bosch	ADIC/GRAU	
1	D 313 L15	T 161 612	3 842 404 498	15A 200 036	L2-L3
2					
3					
4					
Main Tower	D 315 L10	T 161 613	3 842 404 499	15A 200 037	L2-L3
Aux. Tower					



#### Information

Observe the position of the Jumper of the MCO module.



1 Jumper position (☞ table)

Fig. 10-11: Drive Amplifier: MCO-Module

a) Set the jumper (1) of MCO module (☞ table)

b) Check the software version on the board (number on EPROM's)

EPROM	Version of Robot Software	Version of Robot and Tower Software
A5	B80858-001	B80858-002
A6	B80859-001	B80859-002



### ATTENTION!

**If the drive amplifier is still unparamaterized, load the parameters before starting operation.**

**Operation is possible with parameters only.**

### Connect AMU to the board

- Switch on the main switch
- Connect the installation cable to the AMU interface COM1 or COM2  
(if necessary disconnect another cable)
- Connect the installation cable to the drive amplifier socket X6
- Open AMU OS/2 window
- Change to directory "C:MOOG" (`cd moog`)
- Call up the communication program "BOSCHTRM" (`boschtrm`)
- Enter <C> for „Configure“
- Adjust the configuration
  - Communication Mode      RS 232      <1>
  - Communication Port      COM1      <1>
  - COM2      <2>
  - Interface type      IQ 140/RHO3      <2>
  - Help file      IQ 140/RHO3      <2>

**Parameterizing the drive amplifiers:**


---

Enter first  
letter of a  
command or H  
for help >

input: <CTRL> + <T>

---

File Transfer function.  
'D' to down load from a disk file to the RMC.  
'U' to up-load data from the RMC to a disk file.  
'Q' to return to emulator

---

Please enter option:

input: <D>

---

Please enter the source filename with  
no extension followed by return.

---

Source file:

input: filename, <ENTER>

---

filenames:

- EA1B20 (axis 1)
  - EA2B20 (axis 2)
  - EA3B20 ( axis 3)
  - EA4B20 (axis 4)
  - EHTB20 (Main Tower)
  - ENTB20 (Auxiliary Tower)
- 

Writing parameters to EEPROM.  
Please wait  
Writing new values in EEPROM.  
Ctrl - X to restart with new parameters.  
>

---

Enter first  
letter of a  
command or H  
for help >

input: <CTRL> + <X>

---

Defaults Set  
from EEPROM

---

Moog T161-21X  
6/4/92  
EEPROM ID  
- more -

input: <ENTER>

---

---

Enter first  
letter of a  
command or H  
for help >

input: <SHIFT>+<\*>

---

Privileged  
Mode  
(Y/N) >>

input: <Y>

---

Password ?  
OK!  
-more-

input: <7>, <8>, <2>, <3>

---

Enter first  
letter of a  
command or H  
for help >

input: <o>, <o> (letter)

---

Home Position  
Offset [Deg]  
12  
-more-

input: <ENTER>

---

Offset [Deg]  
  
0 - 360  
?

Input HPO values from software  
backup,  
<ENTER>

---

Enter first  
letter of a  
command or H  
for help >

input: <C> (save)

---

Sure (Y/N)?

input: <Y>

---

EEPROM ID ?

input: number of the axis,  
<ENTER>

---

Wait-

---

Saving Defaults  
Gaints in EEPROM

---

Enter first  
letter of a  
command or H  
for help >

input: <ESC> ,<Y>

- i) Disconnect the installation cable (if necessary reconnect other cable)
  - AMU interface
  - drive amplifier socket X6
- j) Quit the OS/2 window
- k) Reset the control unit: press the reset button on the power supply PS75

10.4.8 Amplifier Series T161-2xx

Mounting



ATTENTION!

Don't mix up the types of the drive amplifier and the MCO modules.

Axis	Motor	Drive Amplifier			MCO Module		
		Type	Bosch	ADIC/ GRAU	Type	Bosch	ADIC/ GRAU
1	D 313 L15	T 161 212	3 842 403 198	15A 200 009	B 48 518-303	3 842 403 202	15 A 200 013
2							
3							
4							
Main Tower	D 315 L10	T 161 213	3 842 403 199	15A 200 003	B 48 518-510	3 842 403 442	15 A 200 043
Aux. Tower							

a) Observe the mounting position of the MCO module

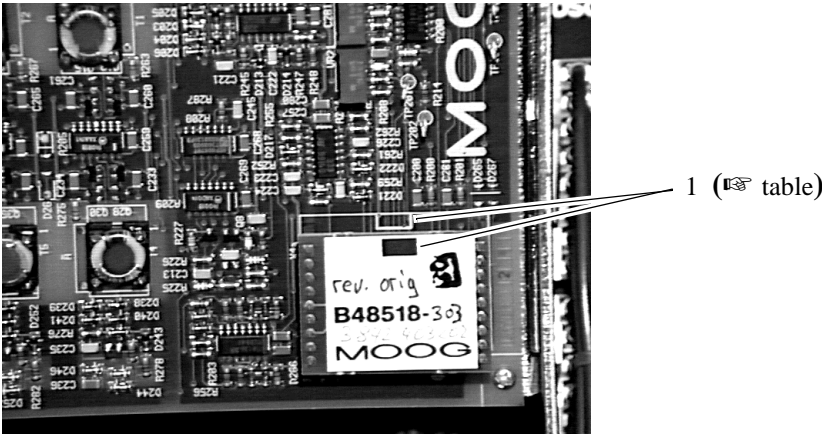


Fig. 10-12: Drive Amplifier: MCO-Module

**Information**

**The marks (1) on the board and on the MCO module must agree.**

- b) Plug in the MCO module
- c) Plug in the board
- d) Tighten the fastening screws

**ATTENTION!**

**If the drive amplifier is still unparamaterized, load the parameters before starting operation.**

**Operation is possible with parameters only.**

- e) Connect AMU to the board
- f) Switch on the main switch
- g) Connect the installation cable to the AMU interface COM1 or COM2  
(if necessary disconnect another cable)
- h) Connect the installation cable to the drive amplifier socket X6
- i) Open AMU OS/2 window
- j) Change to directory "C:\MOOG" (cd moog)
- k) Call up the communication program "Terminal" or "BOSCHTRM"
- l) Enter <C> for „Configure“
- m) Adjust the configuration
 

- Communication Mode	RS 232	<1>
- Communication Port	COM1	<1>
	COM2	<2>
- Controller Type	T 161 Series	<2>

**Parameterizing the drive amplifiers (axes 1-4)****Information**

**main tower and auxilary tower (☞ page 10 - 22).**

- a) Press <ENTER> and wait until the following message appears:

---

Enter first  
letter of a  
command or H  
for help >

input: <SHIFT> + <\*>



## Control Unit

---

Privileged Mode (Y/N) >>	input: <Y>
Password ? OK!	input: <7>, <8>, <2>, <3>
Enter first letter of a command or H for help >	input: <D>
Sure (Y/N) ?	input: <Y>
Moog T161-21X 6/4/92 EEPROM ID 0 - more -	input: <ENTER>
Drive Disabled RHO Sample Period [ms] ?	input: <2>, <0>, <ENTER>
Controller: - e.g. T161-211 ?T161-21_	input: <2>, <ENTER>
Motor:- e.g. D314 .. L10 304 - 111A ?_	input: <D>
?D31_	input: <3>
?D313 .. L_	input: <15>, <ENTER>
T161-212 D313 .. L15 OK (Y/N) ?_	input: <Y>
Wait ...	
CAN Position Loop	
Defaults Set	

---

Enter first  
letter of a  
command or H  
for help >

input: <CTRL> + <T>

---

File Transfer function.  
'D' to down load from a disk file to the RMC.  
'U' to up-load data from the RMC to a disk file.  
'Q' to return to emulator

---

Please enter option:

input: <D>

---

Please enter the source filename with  
no extension followed by return.

---

Source file:

input: filename, <ENTER>

filenames:

- EA1M20
- EA2M20
- EA3M20
- EA4M20

---

Writing parameters to EEPROM.  
Please wait  
Writing new values in EEPROM.  
Ctrl - X to restart with new parameters.  
>

---

Enter first  
letter of a  
command or H  
for help >

input: <CTRL> + <X>

---

Defaults Set  
from EEPROM

---

Moog T161-21X  
6/4/92  
EEPROM ID  
- more -

input: <ENTER>

---

Enter first  
letter of a  
command or H  
for help >

input: <SHIFT>+<\*>

---

Privileged  
Mode  
(Y/N) >>

input: <Y>

---

Password ?  
OK!  
-more-

input: <7>, <8>, <2>, <3>

---

Enter first  
letter of a  
command or H  
for help >

input: <o>, <o> (letter)

---

Home Position  
Offset [Deg]  
12  
-more-

input: <ENTER>

---

Offset [Deg]  
  
0 - 360  
?

Input HPO values from software  
backup,  
<ENTER>

---

Enter first  
letter of a  
command or H  
for help >

input: <C> (save)

---

Sure (Y/N)?

input: <Y>

---

EEPROM ID ?

input: number of the axis,  
<ENTER>

---

Wait-

---

Saving Defaults  
Gaints in EEPROM

---

Enter first  
letter of a  
command or H  
for help >

input: <ESC> ,<Y>

- b) Disconnect the installation cable (if necessary reconnect other cable)
  - AMU interface
  - drive amplifier socket X6
- c) Quit the OS/2 window
- d) Reset the control unit: press the reset button on the power supply PS75

### Parameterizing the drive amplifiers (main tower and auxiliary tower)

- a) Press <ENTER> and wait until the following message appears:

---

Enter first letter of a command or H for help >	input: <SHIFT> + <*>
--	----------------------

---

Privileged Mode (Y/N) >>	input: <Y>
--------------------------------	------------

---

Password ? OK!	input: <7>, <8>, <2>, <3>
-------------------	---------------------------

---

Enter first letter of a command or H for help >	input: <D>
--	------------

---

Sure (Y/N) ?	input: <Y>
--------------	------------

---

Moog T161-21X 6/4/92 EEPROM ID 0 - more -	input: <ENTER>
--	----------------

---

Drive Disabled RHO Sample Period [ms] ?	input: <2>, <0>, <ENTER>
--	--------------------------

---

Controller: - e.g. T161-211 ?T161-21_	input: <3>, <ENTER>
---	---------------------

---

## Control Unit

---

---

Motor:-

e.g. D314 .. L10

304 - 111A

?\_

input: <D>

---

?D31\_

input: <5>

---

?D315 .. L\_

input: <1>, <0>, <ENTER>

---

T161-213

D315 .. L10

OK (Y/N) ?\_

input: <Y>

---

Non Standard

Motor

Enter Parameters

(Y/N) ?

input: <Y>

---

Kt [Nm/A]

?

input: <0>, <.>, <5>, <9>,  
<ENTER>

---

Number

Motor Poles

?

input: <1>, <2>, <ENTER>

---

Motor

Current

Limit [A]

?

input: <2>, <5>, <ENTER>

---

Max Speed

[RPM] ?

input: <5>, <8>, <0>, <0>,  
<ENTER>

---

Wait ...

---

CAN Position Loop

---

Defaults Set

---

Enter first

letter of a

command or H

for help >

input: <CTRL> + <T>

---

File Transfer function.

'D' to down load from a disk file to the RMC.

'U' to up-load data from the RMC to a disk file.

'Q' to return to emulator

---

Please enter option:

input: <D>

Please enter the source filename with  
no extension followed by return.

Source file:                   input: filename, <ENTER>

filenames Quadro tower:

- EHTM20
- ENTM20

```
Writing parameters to EEPROM.
Please wait
Writing new values in EEPROM.
Ctrl - X to restart with new parameters.
>
```

```
Enter first
letter of a
command or H
for help >          input: <CTRL> + <X>
```

```
Defaults Set
from EEPROM
```

```
Moog T161-21X
6/4/92
EEPROM ID          input: <ENTER>
- more -
```

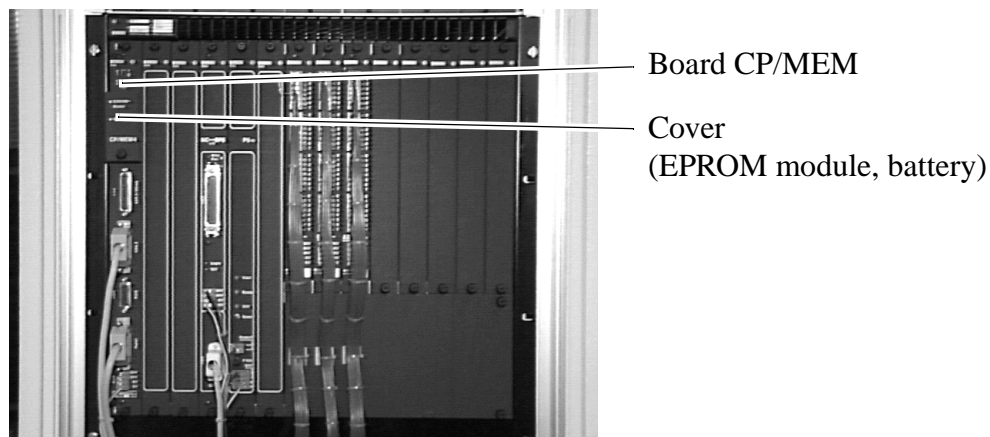
```
Enter first
letter of a
command or H
for help >          input: <ESC>,<Y>
```

- a) Disconnect the installation cable (if necessary reconnect other cable)
  - AMU interface
  - drive amplifier socket X6
- b) Quit the OS/2 window
- c) Reset the control unit: press the reset button on the power supply PS75

### 10.4.9 Board CP/MEM

---

middle, inside the control unit (☞ page 10 - 3)



*Fig. 10-13: rho Control Unit*

#### **Dismounting the board**










- a) Switch off the main switch
- b) Unplug connectors
- c) Loosen fastening screws
- d) Push the retaining levers evenly outward to release the board
- e) Pull out the board

#### **Mounting the board**

- a) Plug in the board
- b) Press the board hard
- c) Tighten the fastening screws
- d) Plug the connectors
- e) Connect the PHG
- f) Switch on the main switch
- g) Let the control system boot

## Check the operating system version

PHG-Mode 7.11










- a) Press , ,  one after the other (diagnosis)
- b) Press , , ,  one after the other (versions)
  - the version number must be "TO03G" or higher
- c) One after the other press ,  (to quit the menu)

## Replace the operating system (EPROM-board) (only if necessary)

- a) Remove the cover (EPROM module, battery)
- b) Pull out the old EPROM board and insert the new EPROM board
- c) Mount the cover

## Adjust the coupling interface

PHG-Mode 9.1.1

- a) Press , ,  one after the other (device/file I/O)
- b) Press , ,  one after the other (interfaces)
- c) Press , ,  one after the other (coupling)
  - interface 0
  - baudrate 9600
  - stop-bit number 1
  - parity 2 (even)
  - word length 8
  - soft-hardware hsk 0
  - timeout read -1
  - timeout write 5000



### Parameterize the board

- a) Call up **AMU Rho File Manager**
- b) List the files contained in the rho control unit
- c) Delete all files in the rho control unit
- d) Insert the backup disk into the AMU drive
- e) Change to the drive A:\SOURCES
- f) Initialize the memory of the board: transfer the file “MPRHO3.BIN” (machine parameters) with the command **Send to Rho**
- g) Call up **Restore**
- h) Change to the drive A:\SOURCES
- i) Start the restore programme
- j) Quit the **Rho File Manager**
- k) Reset the control unit: press the reset button on the power supply PS75
- l) Press <CONTROL ON> when the system has booted

#### 10.4.10 Board NC-SPS-I/O (PIC-Board)

middle, inside the control unit (see page 10 - 3)

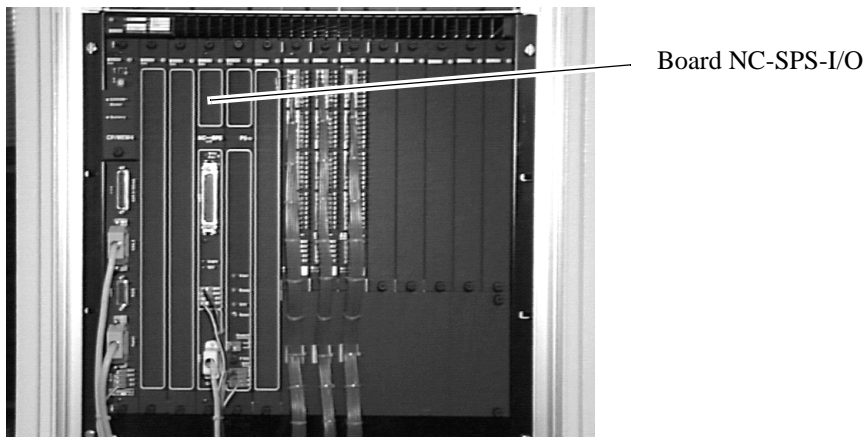


Fig. 10-14: rho Control Unit

#### Fuses

type: MT 3,15 A

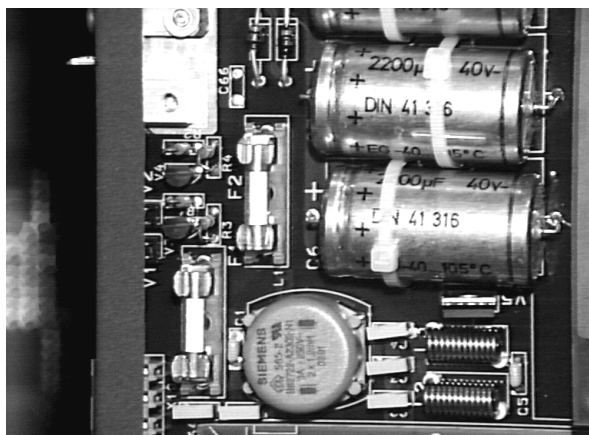


Fig. 10-15: Board NC-SPS-I/O: Fuses

#### Dismounting the board

- a) Switch off the main switch
- b) Unplug connectors
- c) Loosen the fastening screws
- d) Pull out the board

### Mounting the board

- a) Insert the board
- b) Press the board hard
- c) Tighten the fastening screws

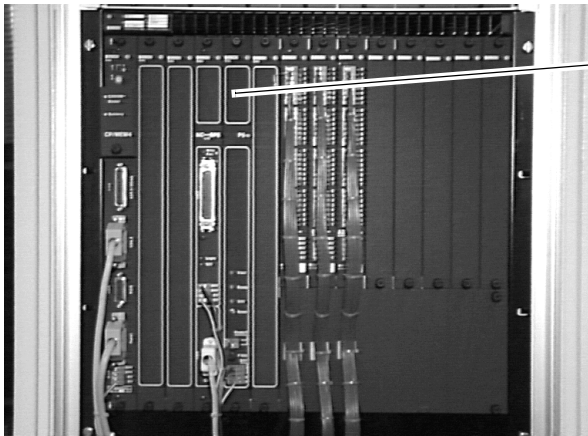
### Parameterize the board

- a) Plug the connectors
- b) Switch on the main switch
- c) Let the control system boot (do not press <CONTROL ON>)
- d) Call up the AMU **Rho File Manager**
- e) Call up the menu item **Send to rho**
- f) Select the partner (robot control system)
- g) Insert the backup disk into the AMU drive
- h) Change to the directory a:\sourcen
- i) Select the file IQ\_AMLE.P2X
- j) Click on **Select**
- k) Click on **Send**
- l) Quit the **Rho File Manager**
- m) Reset the control unit: press the reset button on the power supply PS75
- n) Press <CONTROL ON> when the system has booted

The system is ready to operate.

### 10.4.11 Power Supply PS75 for rho

middle, inside the control unit (☞ page 10 - 3)



Power supply  
PS75

*Fig. 10-16: rho Control Unit*

#### **Fuse**

type: F 10 A

#### **Dismounting the board**

- a) Switch off the main switch
- b) Unplug the connectors
- c) Disconnect the 24 V/0 V supply cable
- d) Loosen the fastening screws
- e) Pull out the board

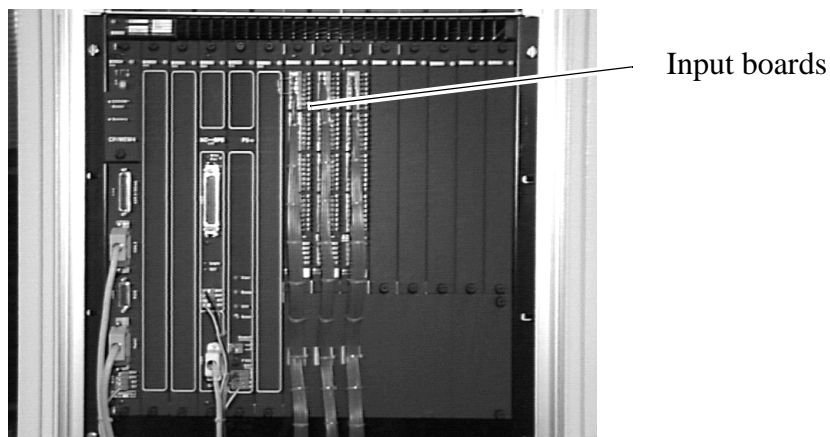
#### **Mounting the board**

- a) Insert the board
- b) Tighten the fastening screws
- c) Plug the connectors
- d) Connect the 24 V/0 V supply cable

### 10.4.12 Input Boards

---

middle, inside the control unit (☞ page 10 - 3)



*Fig. 10-17: rho Control Unit*

#### **Dismounting**

- a) Switch off the main switch
- b) Unplug the connectors
- c) Loosen the fastening screws
- d) Pull out the board

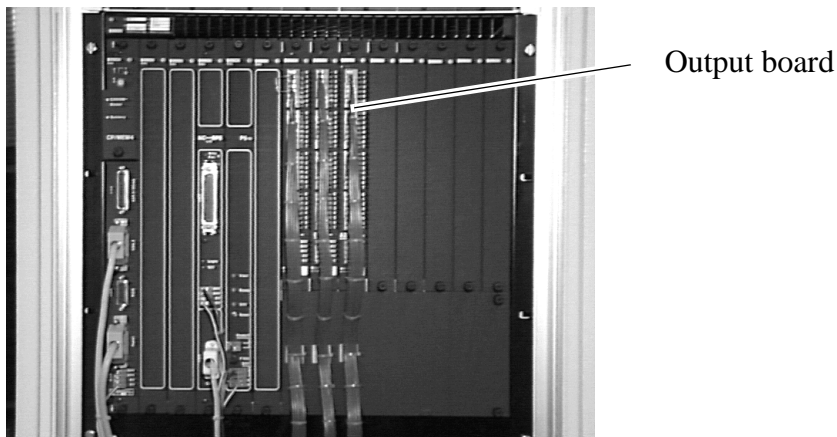
#### **Mounting**

- a) Adjust the address (☞ page 4 - 24)
  - board 1: address 0 (all switches “OFF”)
  - board 2: address 4 (only switch 3 “ON”, remaining switches “OFF”)
- b) Insert the board
- c) Press the board hard
- d) Tighten the fastening screws
- e) Plug the connectors

### **10.4.13 Output Board**

---

middle, inside the control unit (☞ page 10 - 3)



*Fig. 10-18: rho Control Unit*

#### **Dismounting**

- a) Switch off the main switch
- b) Loosen the fastening screws
- c) Pull out the board

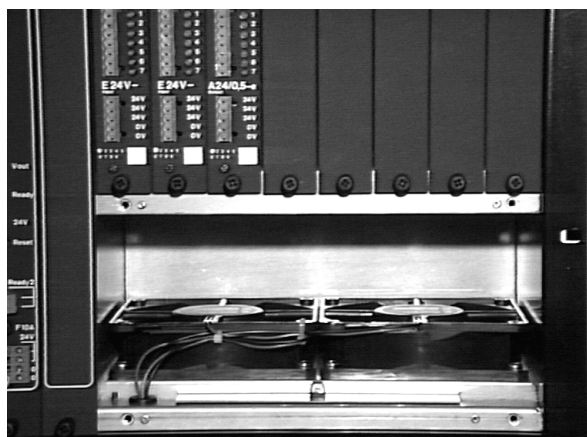
#### **Mounting**

- a) Adjust address 0: all switches “OFF” (☞ page 4 - 27)
- b) Insert the board
- c) Press the board hard
- d) Tighten the fastening screws
- e) Plug the connectors

### 10.4.14 Fans of rho Control Unit

---

middle, inside the control unit (👉 page 10 - 3)



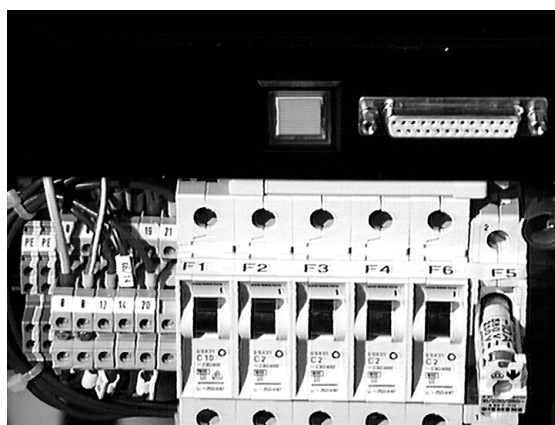
*Fig. 10-19: Fans for Input and Output Boards*

The fans for the boards from CP/MEM to power supply PS75 are mounted below the boards.

### 10.4.15 Fuses of the rho Control Unit (only old systems)

---

middle, inside the control unit (👉 page 10 - 3)



*Fig. 10-1: Fuses of the rho Control Unit*



#### Information

The fuse F5 (far right) is a wire fuse (6 A 380 V) and not a circuit breaker, like the other fuses.

### 10.4.16 Interface Modem

on the bottom inside the control unit (see page 10 - 3)

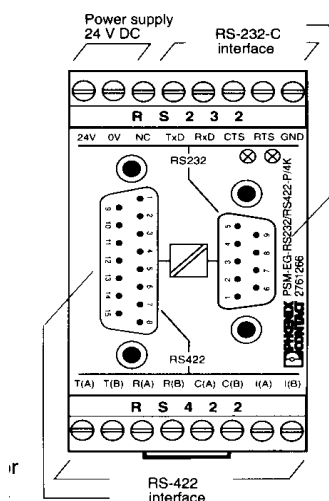


Fig. 10-2: Interface Modem

#### Dismounting

- Switch off the main switch
- Disconnect the shield wire on the housing pin of the Sub-D plug
- Pull the plug
- Using a screw driver, press down the red snap-action lever on the underside of the interface converter
- Unhinge the module upward from the carrying rail
- Disconnect the PE (earthing) contact

#### Mounting

- Check the default settings
  - lever out the housing cover with a screw driver applied at the marked spot, remove the cover
  - check the setting of switch S1 on DTE
  - jumper adjustment X6: pin 2 and pin 4 connected
  - close the cover
- Connect the PE (earthing) contact
- Insert the module on the carrying rail from the top and let it snap into place
- Plug in the connectors on the top and bottom of the module
- Connect the shield wire to the plug housing



### 10.4.17 Frequency Converter MicroMaster

---

on the bottom inside the control unit (☞ page 10 - 3)

*Fig. 10-3: Frequency converter MicroMaster*

#### **Dismounting**

- a) Switch off the main switch
- b) Loosen the cover hood by applying pressure from the side, then lift it off
- c) Disconnect all cables from the frequency converter
- d) Remove the four phillips screws
- e) Remove the frequency converter

#### **Mounting**

in opposite sequence

## Connection



### WARNING!

**The device must be operated only with closed cover hood, because it contains live components.**

- a) Remove the cover hood by releasing the four clamps
- b) Connect the terminals for adjustment and installation

L1, N/L2, PE	power supply and earthing (230V~/50Hz)
U, V, W, PE	motor phases and earthing (max. 300V~)
7	potential related power supply for digital inputs
8	start release
9	creep speed left
10	left
11	creep speed right
12	right

- c) Before operating the device the first time check the terminal connections against the electric diagram
  - operating mode : digital mode
  - control: via the digital inputs

## Operating Elements

4 digit LED	displays operating mode and programme number
yellow LED	indicates rotation direction (on for lefthand rotation)
slide switch SW100	no function (only for analog operation)
button P (blue)	switch-over between parameter-no. and parameter value
buttons “up”, “down”	adjusting buttons for parameter-no. and parameter value

### Manual adjustment

Check the standard values after the first operation (☞ below). Ex works the display is adjusted to show the actual current consumption.

Check at the display

Current	max 2.1 A (during start up approx. 3.0 A for 0.2 s)
Frequency	max 50 Hz

### Operation

Adjust and parameterize with the buttons “P”, “up” and “down”.

Switch over between parameter-no. and parameter value with the “P” button (the parameter-no. is identified by a leading “P” on the LED display).

Select the parameter-no with the buttons “up” and “down”

- current parameter value is shown when you press “P”
- change the value with the “up” and “down” buttons
- return to the parameter number by pressing “P”

### Password parameter

The parameters P001 through P009 can always be edited. The parameters from P010 on are protected by the password parameter P009. The value “0” protects all parameters from P010 on. Enter the value “2” for P009 before changing these. Upon the next power-up P009 is automatically reset to “0”.

### Procedure for re-parameterizing

- a) Switch off the AML/E system
- b) Set the rho control unit to set-up: apply 24 V to input 0.0
- c) Switch on the main switch and let the rho control unit boot
- d) Press <CONTROL ON>
- e) Unlock the protection of the parameters from P010: set parameter P009 to “2”
- f) Delete all parameters: set parameter P944 to “1”
- g) Press <CONTROL OFF> and after 30 s press <CONTROL ON>
- h) Check for errors: P930 contains the list of errors (scroll with “up” and “down”)
  - no errors must be stored in P930 during the parameterizing
  - if P930 contains errors, resume the procedure from the start
  - if P930 contains errors repeatedly, replace the frequency converter
- i) Adjust all parameters of the standard adjustment (☞ page 10 - 39)
- j) Save all parameters permanently: select P000 and press “P”
- k) Switch off the AML/E system
- l) Reset the rho control unit: disconnect 24 V from input 0.0
- m) Switch on the main switch and let the rho control unit boot
- n) Press <CONTROL ON>
- o) Check for errors: no errors must be stored in P930. If P930 contains errors, check the standard adjustment (☞ page 10 - 39)

### Standard adjustment by ADIC/GRAU Storage Systems

This standard adjustment must be altered only when a need arises.

Parameter	Function	Value
P001	Display select <ul style="list-style-type: none"><li>• 0 = output frequency</li><li>• 1 = frequency setpoint</li><li>• 2 = motor current</li><li>• 3 = intermediate circuit voltage</li><li>• 4 = motor torque</li></ul>	2
P002	run-up time (start ramp) in s	0
P003	brake time (stop ramp) in s	0
P004	sloping (edge sloping)	0
P005	frequency setpoint in Hz	50
P006	setpoint selection	2
P009	password parameter (protects from P010 on) <ul style="list-style-type: none"><li>• ex works = 0 (write protected)</li><li>• to allow changes = 2</li></ul>	0
P011	non-volatile setpoint storage	1
P012	min. motor frequency in Hz	0
P013	max. motor frequency in Hz	50
P014	fade-out frequency (for resonance) in Hz	0
P015	automatic re-run-up	1
P021	minimum frequency analog in Hz	0
P022	maximum frequency analog in Hz	50
P023	select analog setpoint	0
P024	add analog setpoint	0
P031	setpoint for touch control, right	0
P032	setpoint for touch control, left	0
P033	run-up time setpoint for touch control in s	0

Parameter	Function	Value
P034	run-down time setpoint for touch control in s	0
P041	1st fixed frequency in Hz (turn left with creep speed)	10
P042	2nd fixed frequency in Hz (turn left with high speed)	50
P043	3rd fixed frequency in Hz (turn right with creep speed)	10
P044	4th fixed frequency in Hz (turn right with high speed)	50
P045	rotation direction (right / left)	5
P051	digital input 1 (DIN)	2
P052	digital input 2 (DIN)	6
P053	digital input 3 (DIN)	6
P054	digital input 4 (DIN)	6
P055	digital input 5 (DIN)	6
P061	relay output 1	1
P062	relay output 2	0
P063	external brake delay switch-on delay	1.0
P064	external brake delay switch-off delay	1.0
P071	slip compensation in %	0
P072	slip limit in %	150
P073	direct current braking in %	0
P074	temperature protection output reduction	0
P075	brake resistance (opt. 65 to 200 Ohm)	0
P076	pulse frequency	0
P077	control mode (current control)	1
P078	voltage increase in % (max. 250)	100

Parameter	Function	Value
P079	initial break away torque in % (max. 250)	100
P081	rated motor frequency (nameplate of motor) in Hz	50
P082	rated motor speed (nameplate of motor) in RPM	1340
P083	rated motor current (nameplate of motor) in A	2.1
P084	rated motor voltage (nameplate of motor) in V	230
P085	rated motor output (nameplate of motor) in kW	0.37
P086	rated motor current limit in %	150
P087	PTC activation	0
P088	auto-calibration	1
P089	stator resistance (is automatically adjusted by the auto-calibration)	ca. 8-14
P091	bus address (between 1 and 30)	1
P092	baudrate (9600)	6
P093	telegram drop-out time in s (0 = none)	0
P094	rated setpoint in % (serial)	100
P101	local standard (Euro = 0, USA = 1)	0
P910	control mode (internal = 0, external = 1)	0
P944	factory settings	0

### Error messages

Errors are displayed on the display as numeric codes with a leading “F” (e. g. F001) (☞ page 11 - 11). Errors are stored in P930, warnings are recorded in P931 until power-down.



### ATTENTION!

**When errors are stored the saving of parameters will present problems.**

**Before saving parameters erase all errors.**

### 10.4.18 Control Unit Connecting Panel

on the bottom inside the control unit (☞ page 10 - 3)

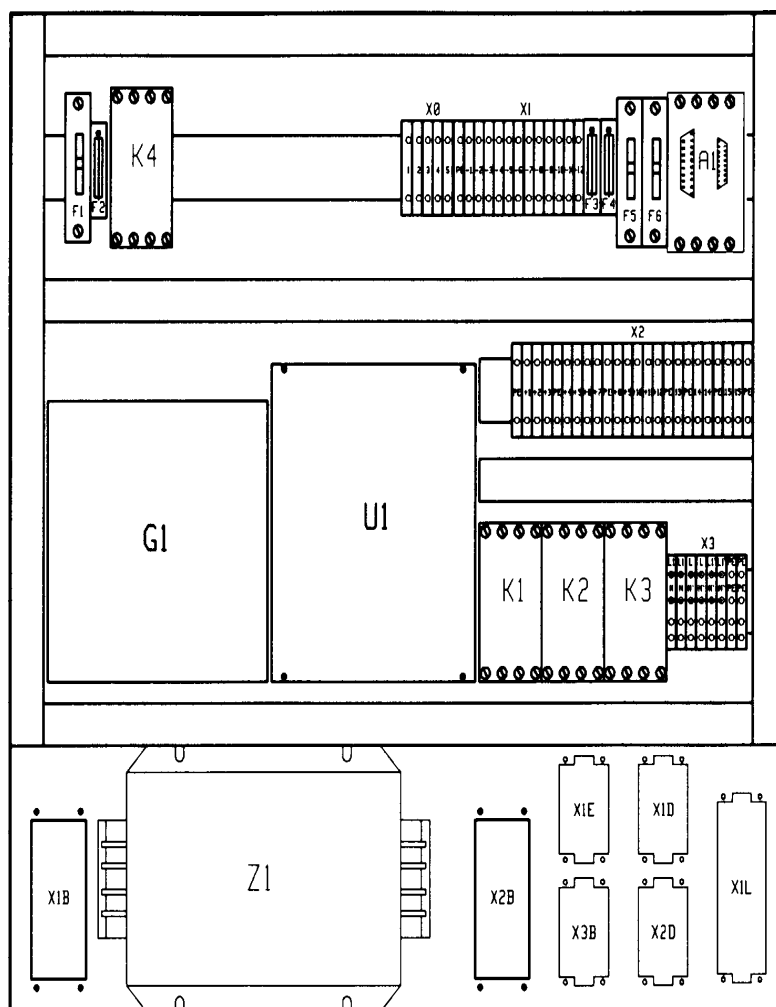


Fig. 10-4: Control Unit Connecting Panel



# 11 Error Messages and Trouble Shooting

---

## 11.1 General Information

---

All messages, including the error messages, are displayed in the log window of the AMU operating console (➤ ARG). The error number appears in brackets at the end of the message.

Additionally the host processor receives an error information.

You can call up additional information on the operating system level (in an OS/2 window).

a) Enter `help amuxxxx`  
      xxxx means error number

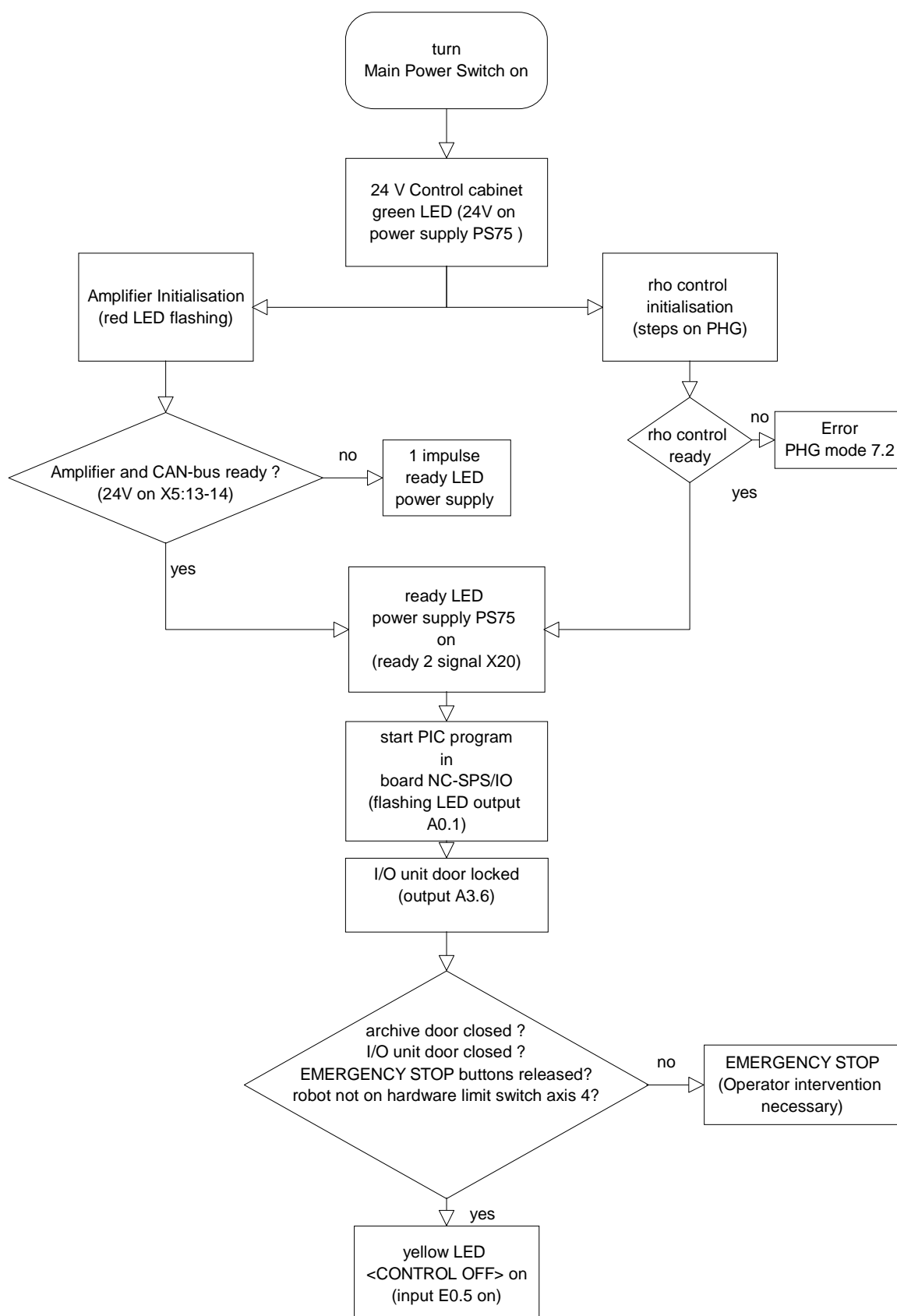
If no solution is given or if you cannot otherwise resolve the error, inform the maintenance technician of your service partner or ADIC/GRAU Storage Systems.

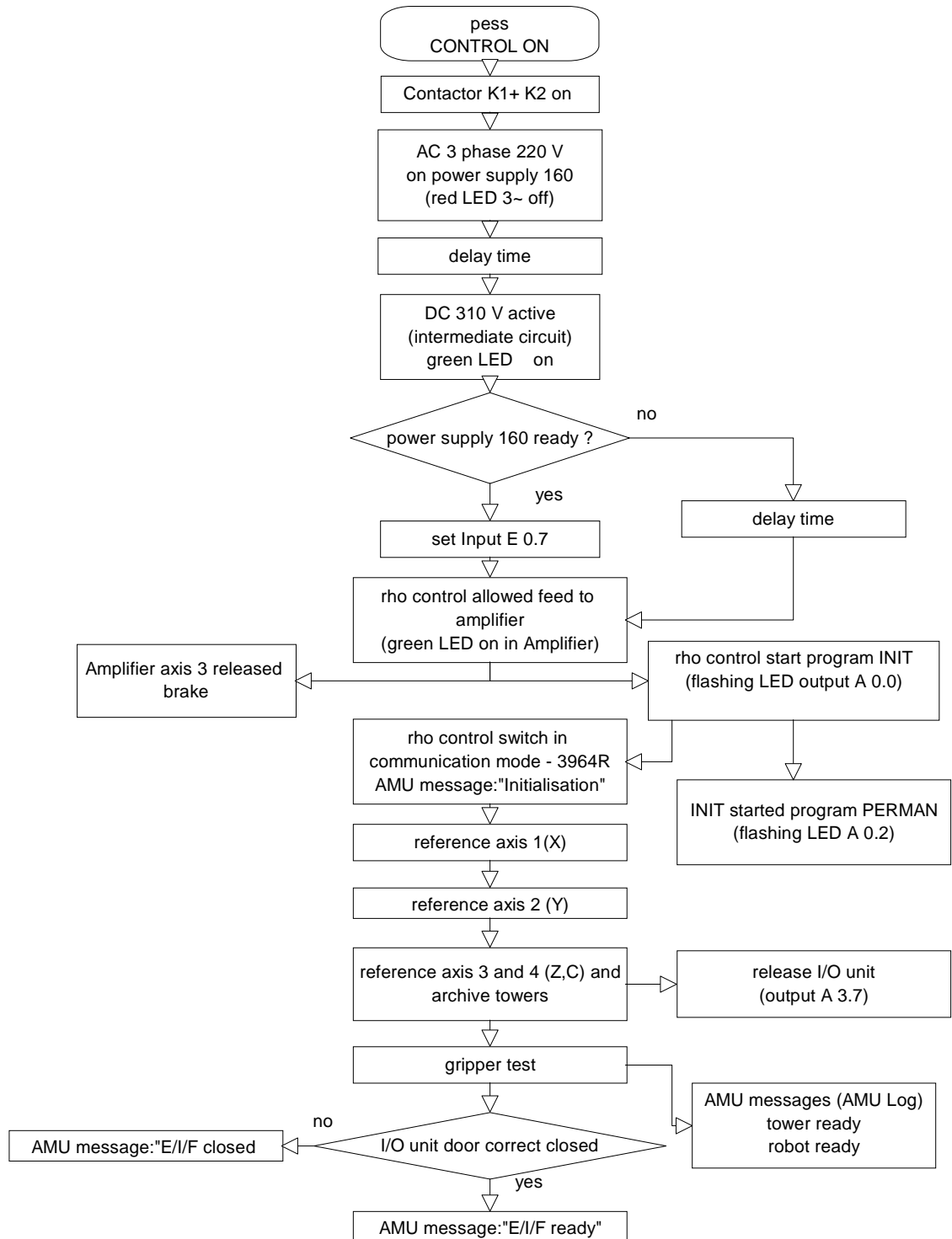


### CAUTION!

**If you need to enter the archive to find or resolve an error, be sure to observe the safety rules (➤ page 3 - 1).**

## 11.2 Trouble Shooting upon Power-Up of





### 11.3 Trouble Shooting upon EMERGENCY STOP

---

The AML/E system is protected by an electric circuit.

The circuit comprises several guards for protection

- <EMERGENCY STOP> buttons
- safety switches, limit switch, door interlocks
- query of ready signals (rho control, drive amplifiers)

When a guard is triggered the circuit is interrupted.

#### 11.3.1 EMERGENCY STOP Circuit

---

EMERGENCY STOP shuts down the power output electronics (contactor in the control unit) and interrupts the circuits CONTROL ON.




**WARNING!**  
**Hazardous voltage!**

**Pressing the <EMERGENCY STOP> button does not render the entire AML/E system voltageless. Only the drive amplifiers are shut off.**

The following are integrated into the EMERGENCY STOP circuit:

- <EMERGENCY STOP> buttons
  - on the I/O unit
  - on the control unit
  - in the archive (new systems)
- safety switches
  - archive access

### 11.4 Failures during Barcode Reading

Possible Causes	Remedy
hardware failure	<p>Check:</p> <ul style="list-style-type: none"> <li>• cable connection</li> <li>• DC Voltage on DC-DC converter (☞ “Clamp connection table of DC-DC converter on scanner” from page 11 - 6)</li> </ul> <p>reset rho and scanner (switch off power of robot control cabinet)</p> <p>In an emergency the system can operate without barcode reading.</p> <ul style="list-style-type: none"> <li>• 24 V at inputs E3.0 in the robot cabinet</li> <li>• send HOST command “BOFF”</li> </ul>
unreadable barcode label	<p>Replace damaged or contaminated barcode label.</p> <div style="display: flex; align-items: center;">  <div style="margin-left: 10px;"> <p><b>ATTENTION!</b></p> <p><b>Try to find the cause for the damage.</b></p> <p><b>If the handling is adjusted badly the gripper may damage barcode labels.</b></p> </div> </div>
bad adjustment during installation	<p>Parameter error: during the installation, parameters for optimal barcode reading are adjusted.</p> <p>Changes such as</p> <ul style="list-style-type: none"> <li>• gripper replacement</li> <li>• different or new media</li> <li>• changed lighting</li> </ul> <p>call for a correction of these parameters:</p> <ul style="list-style-type: none"> <li>• measure the parameters with the robot test program (☞ page 6 - 7)</li> <li>• enter the parameters in KONFIG.DAT</li> <li>• check the changed parameters (several compartments on different storage towers)</li> <li>• enter the parameters on the datasheets</li> <li>• save KONFIG.DAT</li> </ul>

### Clamp connection table of DC-DC converter on scanner

Pin	Color	Voltage
1	brown	+ 24 V
2	blue	0 V
3	black	- 12 V
4	violet	+ 12 V
5	pink	5 V
6	green/yellow	GND

### 11.5 Error Messages of the Drive Amplifiers

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#### 11.5.1 Displaying Error Messages with the “Terminal” Program

---

- a) Switch on the main switch
- b) Open the AMU OS/2 window
- c) Change to directory “C:\MOOG” (cd moog)
- d) Call up the communication program “BOSCHTRM” (boschtrm)
- e) Enter <C> for „Configure“
- f) Adjust the configuration
  - Communication Mode RS 232 <1>
  - Communication Port COM1 <1>
  - COM2 <2>
  - Interface type IQ140/RHO3 CAN <2>
  - Helpfile IQ 140/RHO <2>
- g) Press <ENTER> and wait until the following message appears:

---

Enter first	call-up of the motor variables
letter of a	
command or H	
for help >	input: <?>

---

h) Enter the motor variable

- <F> error
- <V> angle speed of motor shaft [1/min]
- <L> current limit [A]
- <B> output amplifier temperature [°C]
- <M> motor temperature [°C]

---

... Occured

occurred protocolled error

... Present

active error

next error: <ENTER> After the last error the following appears:

---

Enter first  
letter of a  
command or H  
for help >

input: <ESC>

---

i) Disconnect the installation cable (if necessary reconnect the other cable)

- AMU interface
- drive amplifier socket X6

j) Quit the OS/2 window



## Error Messages of the Drive Amplifiers

### 11.5.2 List of Errors

During every second communication cycle the drive is checked for errors by a logic module. When an error is found the operating status changes.

Error	Notes	Solution
Bridge Short Circuit Fault	Each of the three motor-phases is equipped with a current sensor. If a short circuit lasts for more than 15 microseconds the output transistors are shut off by a hardware circuit and a signal for later measures is stored by the logic module.	Check: connecting cable to the motor, replace motor or amplifier if necessary
Analog Power Supply Fault	During every second communication cycle a logic module monitors the comparators; these in turn check the +15 V and -15 V supply.	replace amplifier or power supply unit
300 V Power Supply Fault	During every start time the logic module checks the supply power for <ul style="list-style-type: none"><li>• temperature &gt;110 °C</li><li>• intermediate circuit voltage &gt;420 V</li><li>• phase loss for 100 milliseconds</li></ul> If one or more of the above conditions are true, the output transistors are shut down during a start time.	replace power supply unit or drive amplifier
Commutation Fault	The logic module checks whether the MCO is installed.	check the MCO module
Resolver Fault	The module of the cosine and sine signals of the resolver is checked during every communication cycle. If it is less than half of the correct value, an error message is transferred twice to the logic module.	check the connecting cable to the motor, if necessary replace motor or drive amplifier
Parameter Fault	A parameter error occurs when the drive has no valid parameters/no valid software due to an initialization error or RAM defect. All parameters are summarized in a checksum which is checked at an interval of 64 communication cycles. If the checksum is wrong, an error message is transferred to the logic module. (Each data element not continuously recalculated is considered a parameter).	reload parameters, if necessary replace amplifier
Bridge Temperature Fault	The temperature of the heat sink of the output transistor is checked at an interval of 64 communication cycles (= 1s). If it rises above 85 °C, a bridge temperature fault is reported to the logic module, and the drive is inactivated.	check fan and ambient temperature, if necessary replace the drive amplifier
motor temperatureFault	If the motor temperature rises above 155 °C for 0.75 seconds, a motor temperature fault is reported, and the drive is inactivated.	check parameters (reload), if necessary replace motor
Thermal Warning	If the motor temperature rises above 130 °C for 0.75 seconds, or if the heat sink temperature of the output transistor is above 70 °C, the drive submits a thermal overload warning to the RHO.	check ambient temperature, fan

## Error Messages of the Drive Amplifiers

Error	Notes	Solution
CAN Bus-Fault	<ul style="list-style-type: none"> <li>During a communication cycle no synchronization telegram is received.</li> <li>The synchronization telegram is received, but this happens neither during the first nor during the last start time of a communication cycle.</li> <li>Within 2 milliseconds after a synchronization process no COMMAND (setpoint) telegram is received.</li> <li>The ACTUAL telegram cannot be send.</li> </ul>	MPRHO3.BIN in rho: check cycle time reload parameter P005 in drive amplifier, if necessary replace the drive amplifier
CAN Interpolation Fault	<p>The COMMAND_POSITION (setpoint position) contained in the COMMAND_TELEGRAM (setpoint telegram) must be reached during one communication cycle (= time between two synchronization processes). This results in a certain speed. The drive amplifier- speed, however, is always checked for agreement with the <math>\delta</math> speed limit of the manual or automatic operating modes.</p> <p>If RHO implicitly requires a higher speed than that specified by the speed limit value for the manual or automatic operating mode, the drive amplifier outputs the CAN_INTERPOLATOR_FAULT_BIT (Bit 9) of the STATUS word contained in the ACTUAL telegram. The drive amplifier outputs this bit as soon as this error occurs and resets it when the error is resolved.</p>	Check mechanics, brake, connecting cables and parameters, if necessary replace the amplifier
CAN Global Fault	This bit is output by the drive amplifier logic-module as soon as it detects a condition preventing the release of the drive system. This bit is never output alone.	

## **11.6 Hexatower**

---

### **11.6.1 Frequency Converter Micromaster**

---

Errors are indicated by a leading “F” on the display.

Erase them by shutting down and back on again.

<b>Error</b>	<b>Description</b>
F001	overvoltage
F002	excess current
F003	overload
F004	motor overtemperature
F005	frequency converter overtemperature
F008	error USS
F009	undervoltage
F010	initialization error
F011	error on internal interface
F012	error on serial interface
F013	program error
F106	parameter error
F112	parameter error
F151	parameter error
F154	parameter error

### 11.6.2 Hexa Tower Signals (only for old installation)

---

Possible errors without AMU error message

- segments are positioned wrongly  
(actual segment position deviates from AMU coordinate)
- unintentional dynamic archive management; multiple crashes without preceding warnings

Cause

- relay K3 fails: switch-over to counterclockwise motor rotation on the frequency converter is not activated (only old systems with 2 input boards)

Remedy

- check relay K3, replace if necessary

## 11.7 rho-Controller error

---

### 11.7.1 Controller system error 102 'falsche MK-Bestueck'

---

After initialization of the control operating system appears on the PHG:









```
Systemfehler      102
falsche MK- Bestueck

ENTER --> MP aendern
```



#### Information




The following acts allow for a new parameterizing of the card

- a) Press  ; (Masch.Param.Programm)
- b) One after the other press  ;  ;  ; (Parameter aendern)
- c) One after the other press  ;  ;  ; (Para.fuer PC-Kopplung)
- d) The following parameters are to be confirmed with  or to overwrite:

0	;Schnittstelle
9600	;Baudrate
1.0	;Stop-Bit
gerade	;Parität “ input 2“
8	;Wortlänge
1	;Soft-Hardw. Hsh(0/1)
-1	;Timeout b.Einlesen:
5000	;Timeout b.Ausgeben:













**PHG appears indication:**

Para. f. PC-Kopplung  ENTER --> MP aendern
--

- e) Press  ; (MP progr.)
- f) Press  to leave menu "Parameter aendern"
- g) Press  to leave menu "Masch.Parm.Programm"


**PHG appears indication:**

Systemfehler 102 falsche MK- Bestueck  ENTER --> MP aendern
--











- h) Press  ; (Masch.Param.Programm)
- i) One after the other press  ;  ;  ; (ROB\_1 MP SET)
- j) One after the other press  ;  ;  ;  ;  ;  ; 
- ;(Password for the Systemparameter, there are written only \*)
- k) As long as press  „until PHG appears indication:


Parameter-Nr.:#   
-----------------------------


- l) One after the other press  ;  ;  ;  ;(Maschinenparameter 401)

m) Confirm the following table entries with  and only (CAN Stecker-Nummer und CAN Modu-Eingänge) transfer

**Tabelle Parameter P 401**



P 401	Bestückung der Meß-Systemkarten	
	A01 Servo-K.:	1
	A01 CAN Stecker- Nummer	X  ;  ; 
	A01 CAN Modul- Nr.:	1
	A01 CAN Modul- Eingang	 ; 
	A01 Ref.-Mode:	0
	A01 Pulse/Umdrehung	65536
	A01 Meßsystem-Bewertung	1000.0
	A01 Sollw.-Ausg.:	1
	A02 Servo-K.:	1
	A02 CAN Stecker- Nummer	X  ;  ; 
	A02 CAN Modul- Nr.:	2
	A02 CAN Modul- Eingang	 ; 
	A02 Ref.-Mode:	0
	A02 Pulse/Umdrehung	65536
	A02 Meßsystem-Bewertung	1000.0
	A02 Sollw.-Ausg.:	2

n) Press  to leave menu „ROB\_1 MP SET“

o) Press  to leave menu“Masch.-Param.Programm“

**PHG appears indication:** (from operating system TO03G):

Masch. Param. Programm  
Änderungen ueber-  
nehmen? (J=1/N=0) : #

p) Confirm the safety prompt to write the EEPROM with  ; 

An automatic reset is called

q) Let the control system run up.  
Go to parameterize the CPMEM board

### Parameterize the CPMEM board

- a) Call up AMU **Rho File Manager** (on AMU )
- b) Insert the backup disk into the AMU drive
- c) Change to the drive A:\SOURCES
- d) Initialize the memory of the board: transfer the file “MPRHO3.BIN” (machine parameters) with the command **Send to Rho**
- e) Call up **Restore**
- f) Change to the drive A:\SOURCES
- g) Start the restore programme
- h) Quit the **Rho File Manager**
- i) Reset the control unit: press the reset button on the power supply PS75
- j) Press <CONTROL ON> when the system has booted



# 12 Appendix

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## 12.1 Terms Used

---

<b>AML/E</b>	Automatic cassette tape operating archive; AML/E software and physical archive. /E means Entry.
<b>AMU</b>	<b>AML Management Unit</b> Central intelligence of the AML/E system. Consists of hard and software.
<b>AMU operating console</b>	OS/2 programme for operation of the AML/E system.
<b>Archive</b>	The archive consists of: <ul style="list-style-type: none"><li>- physical archive and</li><li>- logical archive.</li></ul> The physical archive consists of storage towers for cassette tapes and optical disks (= media). The logical archive (archive catalog) is the list of volsers assigned to the compartments in the physical archive.
<b>Archive catalog</b>	An OS/2 database with the logical archive. Contains the assignment of volsers to the compartments in the physical archive as well as further vital information about the media and the drives.
<b>Archive coordinates</b>	These define the compartment of a medium in the physical archive.
<b>Barcode label</b>	Label on the medium, contains the volser in a form readable for the robot (barcode).
<b>Click</b>	Short pressing and releasing of the mouse button.
<b>Command, instruction</b>	A command sent to the AML/E system: <ul style="list-style-type: none"><li>- from the host computer</li><li>- direct operator input at the AMU operator console</li></ul>

<b>Configuration</b>	<p>Determines the structure of the AML/E system. The configuration specifies the components and their connections.</p> <ul style="list-style-type: none"> <li>- host computer</li> <li>- AMUs</li> <li>- rhos</li> <li>- storage towers</li> <li>- linear shelves</li> <li>- handling unit</li> <li>- specials</li> <li>- drives</li> </ul>
<b>Foreign medium</b>	<p>Media not listed with a Volser in the archive catalog. They are processed by the AML/E system via the I/O unit.</p>
<b>Handling box</b>	<p>Storage box for media in the I/O unit.</p>
<b>Handling unit</b>	<p>3-axis robot</p>
<b>Hexa tower</b>	<p>Storage archive with 6 segments for 720, 900 or 1080 media.</p>
<b>Host computer</b>	<p>Large computer system The data of the host computer is stored in the AML/E system (archive) on media.</p>
<b>I/O unit</b>	<p>Input/output area. Media are inserted and ejected via the I/O unit.</p>
<b>Linear shelf</b>	<p>Storage archive (only one storage level)</p>
<b>Medium</b>	<p>Storage medium in the archive, e. g. a magnetic tape cassette or optical disk</p>
<b>Mounting media</b>	<p>Inserting a medium into a drive is referred to as mounting (MONT), removing a medium from a drive is referred to as dismounting (KEEP).</p>
<b>Operator</b>	<p>Trained operator of the AML/E system.</p>
<b>Operating panel</b>	<p>Panel on the control unit allowing to switch the AML/E system on and off and to monitor it.</p>

## Terms Used

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<b>Problem box</b>	9 special compartments in the I/O unit: These house: <ul style="list-style-type: none"><li>- unidentified media</li><li>- media, when the robot fails</li></ul>
<b>Quadro tower</b>	Storage archive with 32 segments.
<b>Scratch media</b>	Scratch media are media released for reuse by the archive. They are used to output data without specified volser (unspecific media request). A column of rows in a storage tower.
<b>Segment</b>	A column of rows in a storage tower.
<b>System media</b>	System media have a volser, are stored and registered in the archive.
<b>Teaching</b>	Teaching of the robot system.
<b>Teach label</b>	White reference marks, these are traced in space (accuracy up to 1/100 mm). They are used to compute all points in the system the robot will have to access. The coordinates of all points taught in are stored in the file KRNREFPT.R0X (X represents the respective robot 1-4).
<b>Unspecific media request</b>	Command to mount a scratch medium or a cleaning cassette.
<b>Volser, VSN</b>	english: <b>volume serial number</b> An up to six digit alphanumeric designation (with leading zeros). It identifies one medium (cassette, optical disk) in the archive. The volser is attached to the rear of the medium on a barcode label and can be read by the robot.

**12.2 Additions to the AMU Operating Console**

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### 12.2.1 Component Types

---

#### Drives

Type	Drive name and number	Medium	Manufacturer
D1	Colorado T1000	TRAVAN	HP
D2	6380	3480 cartridge	COMPAREX
D2	7480	3480 cartridge	HDS
D3	6390	3490 cartridge	COMPAREX
D3	7490	3490 cartridge	HDS
D7	3480 with ACL	3480 cartridge	IBM
D7	3580 with ACL	3480 cartridge	SNI
D8	3480 with flap	3480 cartridge	IBM
D8	3480 with flap	3480 cartridge	SNI
D9	5480	3480 cartridge	MEMOREX
D9	60/3590E	3490 cartridge	MEMOREX
D9	3580, without flap	3480 cartridge	SNI
D9	3590	3490 cartridge	SNI
D9	3480 without flap	3480 cartridge	IBM
D9	3490	3490 cartridge	IBM
D9	3490-TA91	3490 cartridge	DIGITAL
D9	9309 2	3490 cartridge	IBM
DA	ER90	D2 small	AMPEX
DA	DST 310	D2 small	AMPEX
DB	ER 90, DST 310	D2 medium	AMPEX
DC	8205-8mm	8mm cartridge	EXABYTE
DC	7208 011, Mammouth	8mm cartridge	IBM
DC	DC MK 13	8mm cartridge	SNI
DE	DLT 2000 (modified)	TK cartridge	ADIC
DE	DLT 4000 (modifiedcartridge)	TK cartridge	ADIC
DF	DDS 7206 005	4 mm cartridge	IBM
DF	HP 6400/1300 S (DDS-1)	4 mm cartridge	HP
DF	HP 6400/4000 DC (DDS-2)	4 mm cartridge	HP
DH	HP 1300	OD 512	HP
DJ	3995 Jukebox	OD 512	IBM
DK	4480	3480 cartridge	STK
DL	4490 Silverstone	3480 cartridge	STK
DL	9490 Timberline	3480 cartridge	STK

Type	Drive name and number	Medium	Manufacturer
DN	3591	3591 cartridge	SNI
DN	3590 Magstar	3590 cartridge	IBM
DN	8590	3590 cartridge	ADIC
DO	RF7010E, MF for external unit	OD Reflection	PLASMON
DO	RF7010X, MF	OD Reflection	PLASMON
DP	IFD-1300-A Subsystem	OD 512	FUJITSU
DP	OD 1300T	OD 512	HP
DP	OD 6300 650/A	OD 512	HP
DP	NWP-559	OD 512	SONY
DP	MOD 2,6 GB	OD 512	SNI
DP	OS 13	OD 512	SNI
DP	Gigaburst	OD 512	STORM
DQ	M2485	3490 cartridge	Fujitsu
DQ	M2483K-3480/90	3480 cartridge	Fujitsu
DQ	LMS TD 3610	3480 cartridge	Philips
DQ	7492	3490 cartridge	HDS
DS	3588-GL	3480 cartridge	SNI
DS	4890 TwinPeak	3480 cartridge	STK
DT	5180	3480 cartridge	TANDEM
DU	5190	3480 cartridge	TANDEM
DV	RSP 2150 Mountaingate	VHS cartridge	METRUM
DW	OS 25 (HR 650)	CD-ROM	SNI
DW	XM 3501B	CD-ROM	Toshiba
DW	W2001	CD-ROM	SNI
DX	AKEBONO (GY-10D)	DTF-Small	SONY
DX	AKEBONO (GY-10C)	DTF-Large	SONY
DZ	BetaCAM BTS PBC 2800P	BetaCAM	Beta CAM

### I/O unit

- P2: Problembox above I/O unit/B
- P3: Problembox above I/O unit/B Mixed-Media
- P4: Problembox above I/O unit/B for D2
- E2: I/O unit/B 60 with 2 handling boxes
- E3: I/O unit/B 120 with 4 handling boxes

### Storage units

- T0: ADIC/GRAU Quadro turm 18R
- T1: ADIC/GRAU Quadro tower 15R
- T2: ADIC/GRAU Quadro tower 12R
- T3: ADIC/GRAU Hexa tower 18R
- T4: ADIC/GRAU Hexa tower 15R
- T5: ADIC/GRAU Hexa tower 12R
- L0: ADIC/GRAU linear rack 18R
- L1: ADIC/GRAU linear rack 15R
- L2: ADIC/GRAU linear rack 12R

### Robot

- R0: Robot system (AML/2)
- R3: Handling unit (AML/E)

### 12.2.2 Media types

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- C0: 1/2 inch Cartridges
- C1: TK85
- O0: OD Reflexion (9 mm)
- O1: Optical Disk (11mm)
- V0: VHS cartridges
- V1: Exabyte 8mm
- V2: Exabyte 4mm
- V3: D2 small (25 GByte)
- V4: D2 medium (75 GByte)
- V5: Travan
- V6: DTF small
- V7: DTF medium
- R3: Handling unit (AML/E)

## 12.3 Lubricants

The following table lists the admissible lubricants

Kind	Type (manufact.)	Order-No.	Package Unit (AE)	Application	Waste Code
Oil	Grafloscon C-SG 0 Ultra (Klüber)	178 000 079	cartridge 400 g	lubrication for Quadro tower gears (Σ1 AE/tower)	54 202 ☞ 1 below
Grease	Retinax EP2 (Shell)	178 000 001	cartridge 400 g	four point bearing, cross roller bearing on Quadro tower (Σ 1 AE/tower)	54 202 ☞ 1 below
	Isoflex Topas NCA 52 (Klüber)	178 000 000	tin 1 Kg	guide rails of the handling unit	54 202 ☞ 1 below

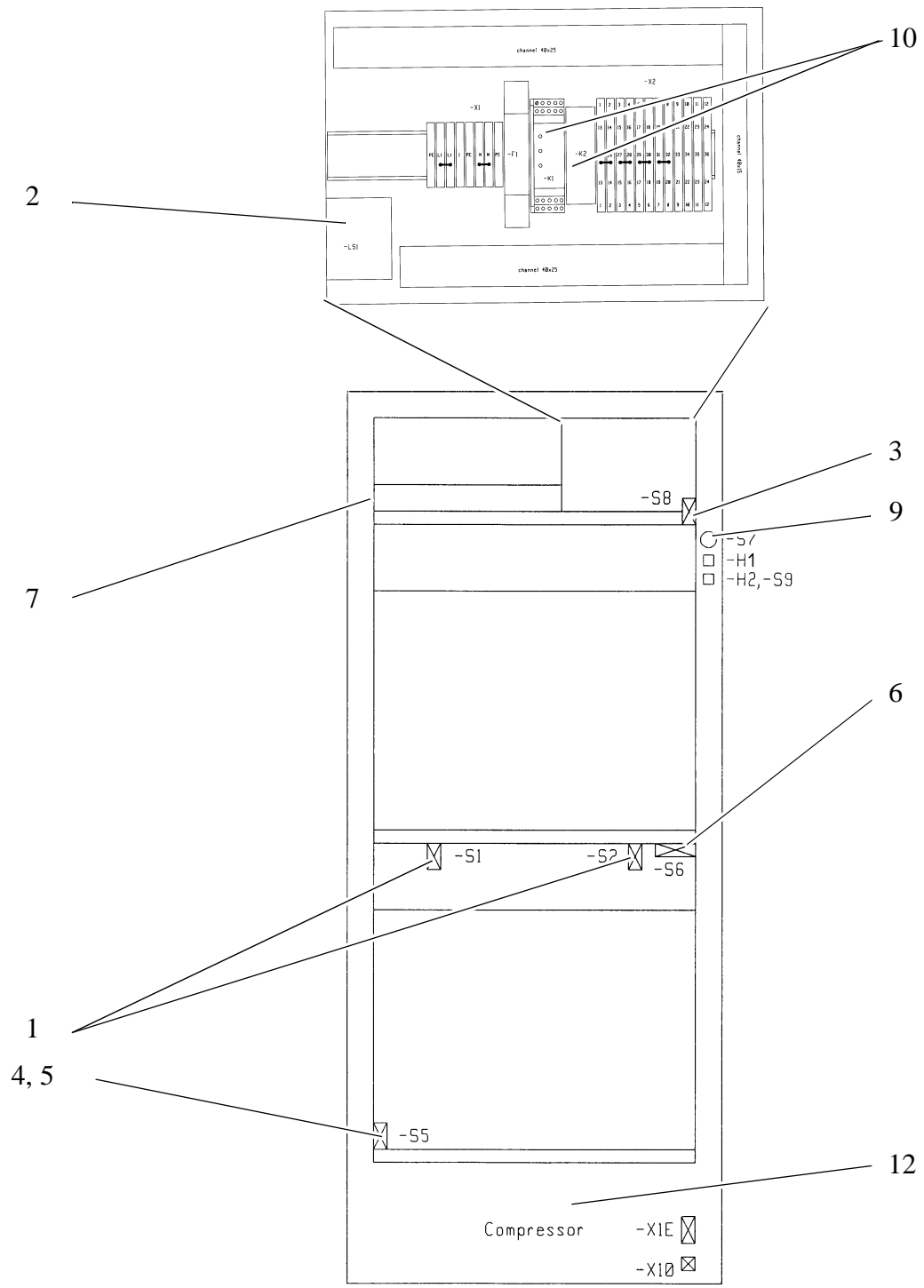
Explanation of the waste code

- 1 Dispose of as problematic waste after consulting with local authorities (burning or problematic waste dump).



12.4 Spare Parts

12.4.1 I/O Unit/B



Pos.	ADIC/ GRAU-No.	Manufac.-No.	Description
-	E40100001		EA-Einheit/B (Ersatzteilkpaket) IO unit/B
1	15s010022	3SE3 200-1E	Positionsschalter (Handlingkoffer vorhanden) position switch
2	15b430004	50019926	Reflex.-Lichtschanke IPRK 9544 (Lichtschanke Problembox) Reflex. light barrier
3	15s010105	3SE3 200-1U	Positionsschalter (Rolladenschalter oben) position switch
4	15s410004		Betätigungsmagnet BPS 33 (Magnet am Rolladenschalter unten) operating magnet
5	323004563	3SE3200OXD	Positionsschalter NA (for S/N > xx-8791) position switch (subsequent work)
	15s410007	BNS 33-11zG	Positionsschalter 3m Kabel (Rolladenschalter unten) position switch 3m cable
6	323002656	160-13YPA	Sicherheitsschalter AZM und Betätigungsriegel NA operating bar and safety switch
7	15b430003	50003189	Kunststoffreflektor TK 30x50mm (für Lichtschanke Problembox) artificial reflector
-	116000106		Rolladen komplett 230V complete shutters
-	116000212		Rolladen komplett 115V complete shutters

## Spare Parts

### Control

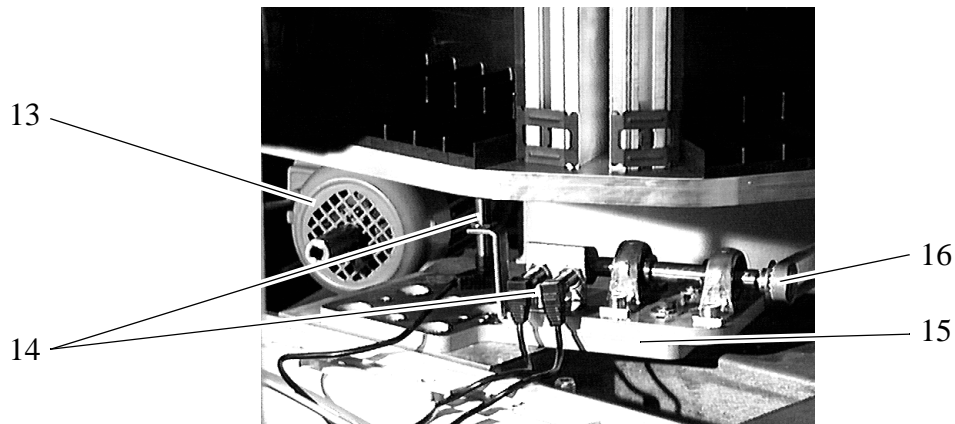
Pos.	ADIC/ GRAU-No.	Manufac.-No.	Description
-	E40700003		EA-Einheit/B - Steuerung (Ersatzteilpaket) IO unit/B control
8	15s410005		Auswerteeinheit AES 1126 evaluating unit (for S/N < xx-8792
9	15s250001	1.30074.001	Taster NOT AUS key emergency-off
10	15k020002	29 50 32 3	relay module (for K1 - K3, K6) 2W EMG 22-REL/KSR-24/21-21 relay module
	15k050004	730521	relay module (for K1.1 -1.3) 2W EMG 22-REL/KSR-24/21-21-29 (for new I/O unit since 1995)
11	15k020001		relay module (for K2) (for S/N > xx-8791)

### Compressed air supply



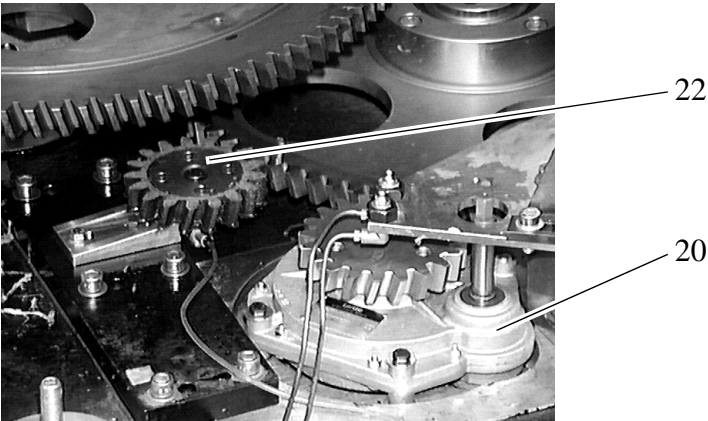
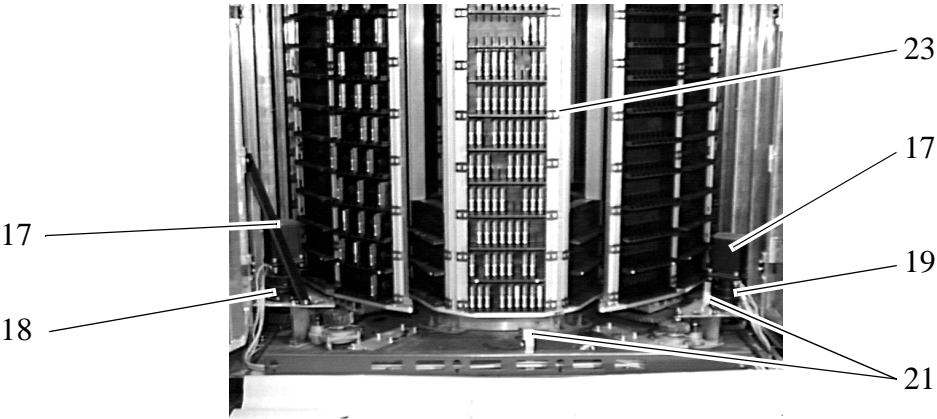
Pos.	ADIC/ GRAU-No.	Manufac.-No.	Description
12	141000094		Kompressor Sondermodell 30/4 230V Compressor special model 30/4
	141000112		Kompressor Sondermodell 30/4 115V Compressor special model 30/4

## 12.4.2 Hexa Tower



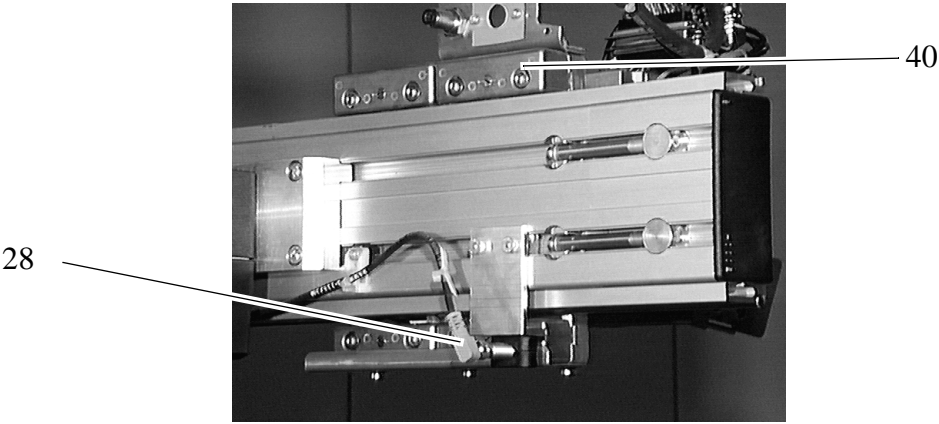
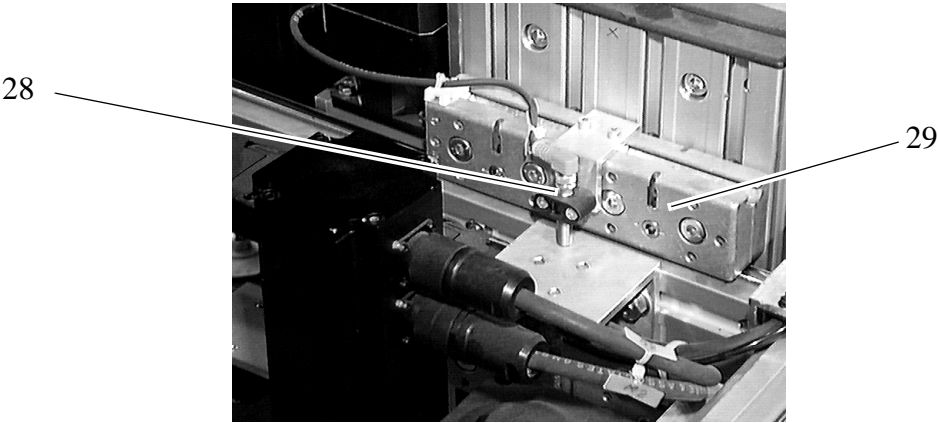
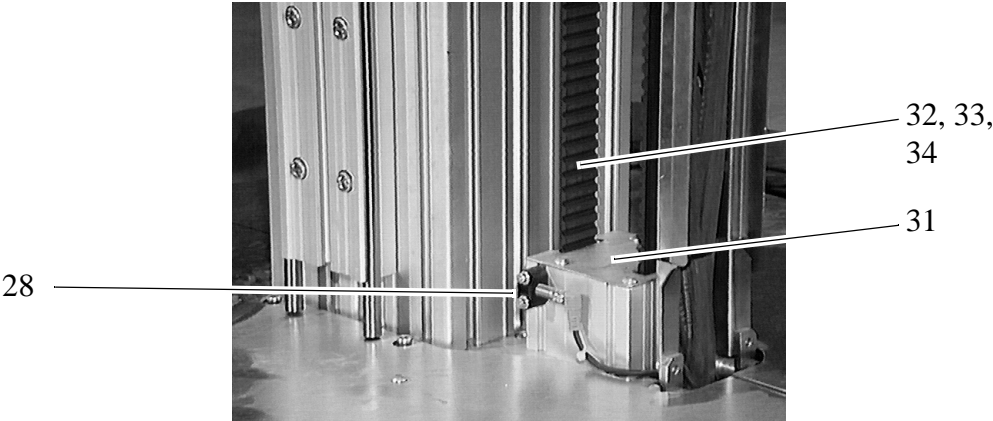
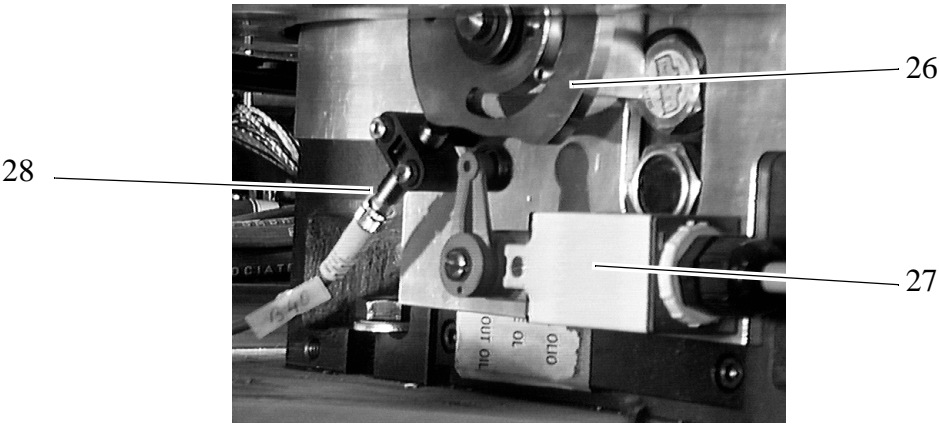
Pos.	ADIC/ GRAU-No.	Manufac.-No.	Description
-	E40100002		Hexa tower 12/15/18R (Ersatzteilpaket) Hexa tower
13	15m880004	S40 - 712/4	Getriebemotor gear motor
14	15b330009	NJ2-12GM40- E2-V1	Näherungsschalter (INPOS-, CHECK-, Referenz-Schalter) proximity switch
15	120000098		Stehlager PBY-15 pedestal bearing
16	118000028		Synchroflex-Zahnriemen 10/T5/940 synchroflex toothed belt
-	323001045		Speicherbox mit Teach-Labels storage box with teach labels

12.4.3 Quadro Tower

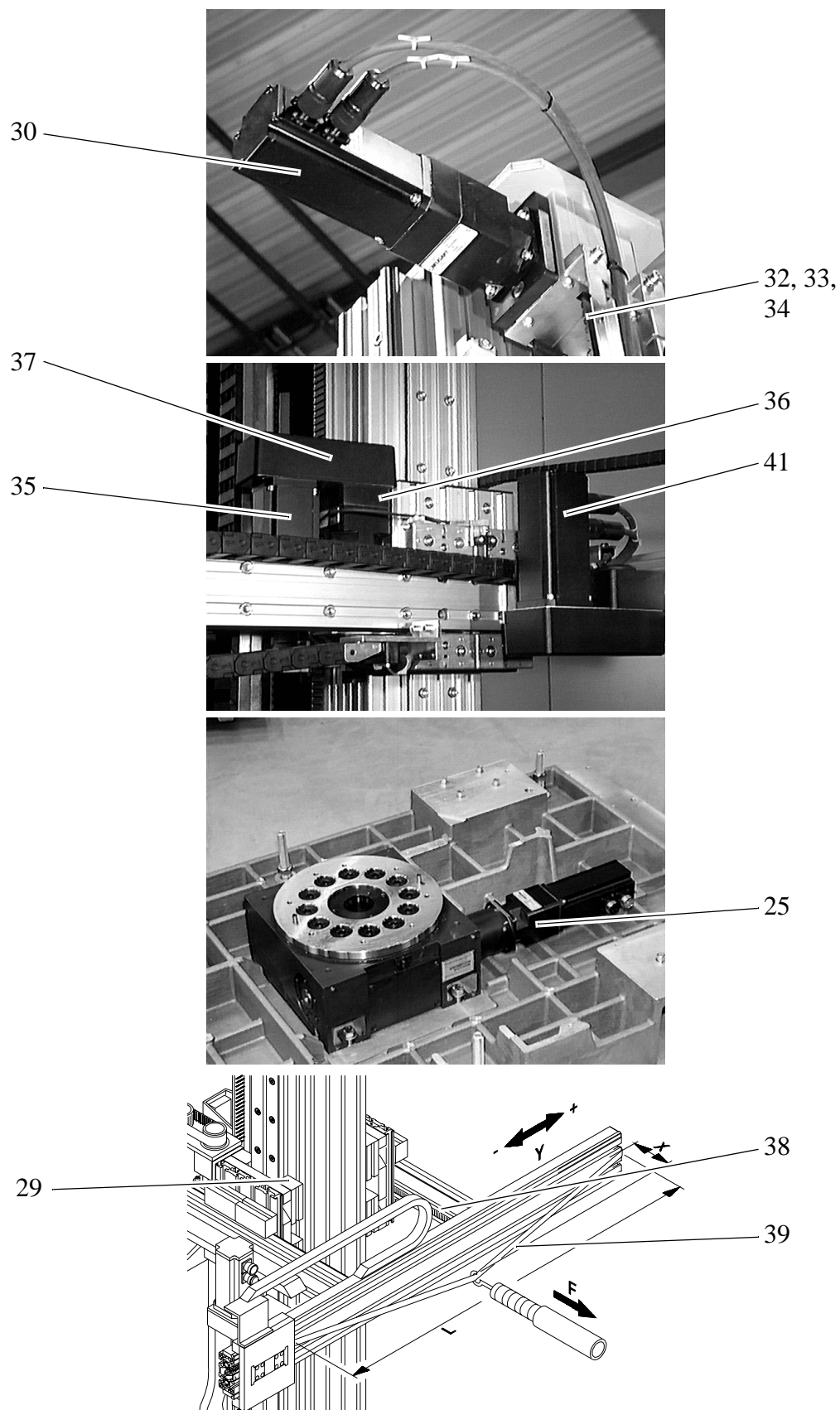


Pos.	ADIC/ GRAU-No.	Manufac.-No.	Description
-	E32100001		Quadro tower 12/15/18R (Ersatzteilpaket) Quadro tower
17	15m200007		Elektromotor für HT und NT electric motor for main tower and auxi- liary tower
18	118000001		Planetengetriebe FABS 25-89 Serie Robus (Hauptturm) planetary gear
19	118000002		Planetengetriebe FABS 15-89 Serie Robus (Nebenturm) planetary gear
20	118000003	12.460.20.11	Aufsteckgetriebe slipover gear
21	15b330001	NJ4-12GM40- E2-V1	Näherungsschalter (Referenzschalter) proximity switch
22	323000191	GC-CuSn12Pb	Filzzahnrad komplett felt gear wheel
23	119000306	717R01-AF	Federclip spring clip
24	15s410001	160-13YPA	Sicherheitsschalter AZM safety switch

12.4.4 Handling Unit









## Spare Parts

Pos.	ADIC/ GRAU-No.	Manufac.-No.	Description
-	E40100003		Handlingseinheit 12R (Ersatzteilpaket) Handling unit
-	E40100004		Handlingseinheit 15R (Ersatzteilpaket) Handling unit
-	E40100005		Handlingseinheit 18R (Ersatzteilpaket) Handling unit
25	158000021	3842 505 000	Motor mit Planetengetriebe Achse 4 motor with planetary gear
26	15s200002		Schalteinrichtung Not-Aus (Schaltkurve) switch gear emergency-off
27	15s010106		Positionsschalter 3SE3 200-1G position switch
28	15b200001		Näherungsschalter M8 x 1 BDG:PNP proximity switch
29	116000131	3842 510 772	Traglager LF 12 (Achse 2+3) supporting bearing
30	158000022	3842 513 049	Motor mit Planetengetriebe Achse 3 motor with planetary gear
31	119000351	3842 515 066	Spannrolle (Riemen Achse 3) stretching roller
32	118000031	3842 514 963	Zahnriemen L=3540 (12R) toothed belt
33	118000030	3842 514 962	Zahnriemen L=4290 (15R) toothed belt
34	118000029	3842 514 961	Zahnriemen L=5040 (18R) toothed belt
35	15m200009		Elektromotor mit Zahnriemenrad f. 1. Achse BO (Achse 1) electric motor with toothed belt wheel for 1st axis BO
36	158000013		Planetengetriebe mit Zahnriemenrad (Achse 1) planetary gear with toothed belt wheel

Pos.	ADIC/ GRAU-No.	Manufac.-No.	Description
37	118000032	3842 514 458	Zahnriemen Super-Torque BO (Vorgelege Achse 1) toothed belt Super Torque
38	116000150	3842 514 459	AT5 schwarz L=1035 (Zahnriemen Achse 1) AT5 black
39	118000034	3842 513 058	Zahnriemen AT5/16 Z=591 BO (Zahnriemen Achse 2) toothed belt
40	116000162	3842 501 754	Traglager (Achse 2) supporting bearing
41	15m200010		Elektromotor mit Zahnriemenrad f. Achse 2 BO (Achse 2) electric motor with toothed belt wheel for axis 2 BO
-	15s410002	160-13YRPA	Sicherheitsschalter AZM (Zugang zum Archiv) safety switch

Cable 12R, 15R, 18R

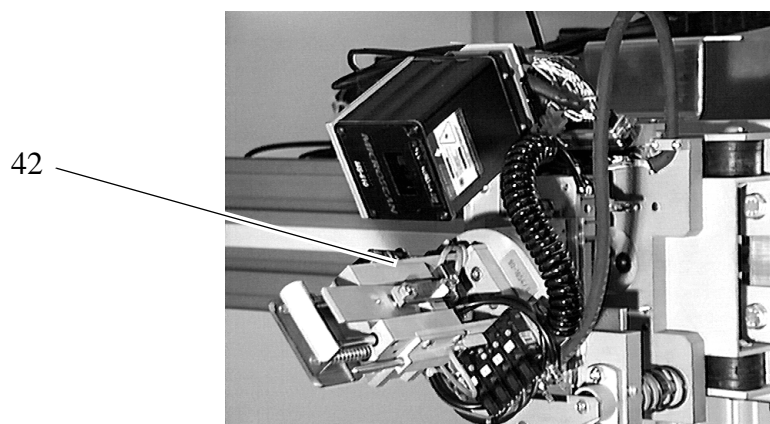
Pos.	ADIC/ GRAU-No.	Manufac.-No.	Description
-	15w200025	3842 514 973	Kabel Ref.Punkt A3 18/15/12 cable reference point A3
-	15w200026	3842 514 035	Kabel Motor A4 18/15/12 cable motor A4
-	15w200027	3842 514 025	Kabel Resolver A4 18/15/12 cable resolver A4
-	15w200028	3842 514 971	Kabel Ref.Punkt A4 18/15/12 cable reference point A4
-	15w200029	3842 514 964	Kabel Not-Aus A4 cable emergency off A4
-	15w200033		Kabelschlepp Handlingseinheit (klein) trailing cable set, handling unit (small)
-	15w200034		Kabelschlepp Handlingseinheit (mittel) trailing cable set, handling unit (middle)

## Spare Parts

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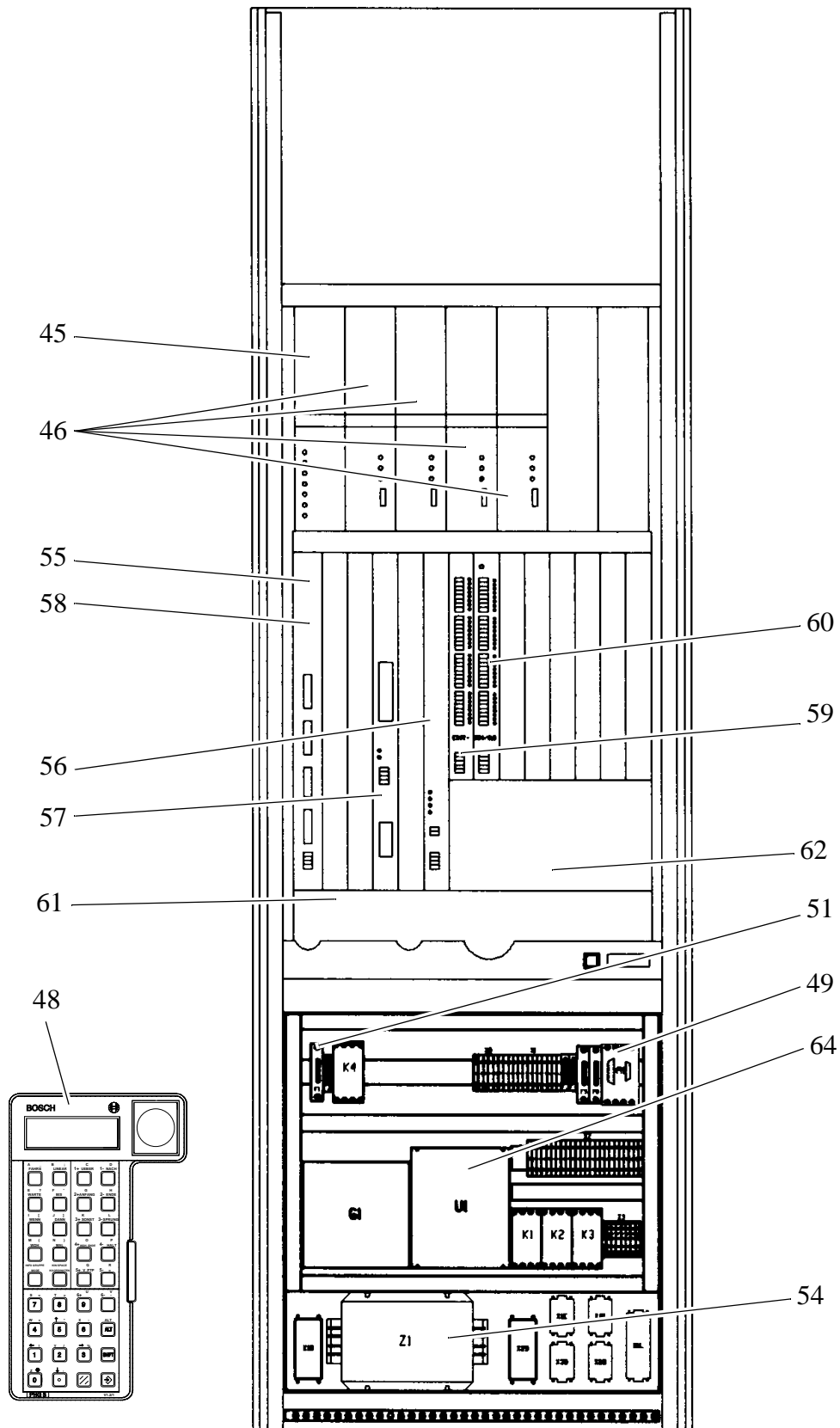
Pos.	ADIC/ GRAU-No.	Manufac.-No.	Description
-	15w200035		Kabelschlepp Handlingseinheit (groß) trailing cable set, handling unit (large)

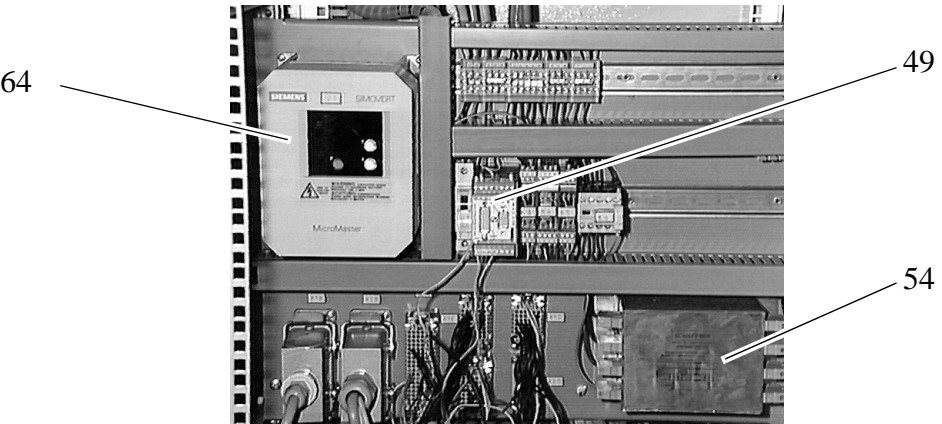
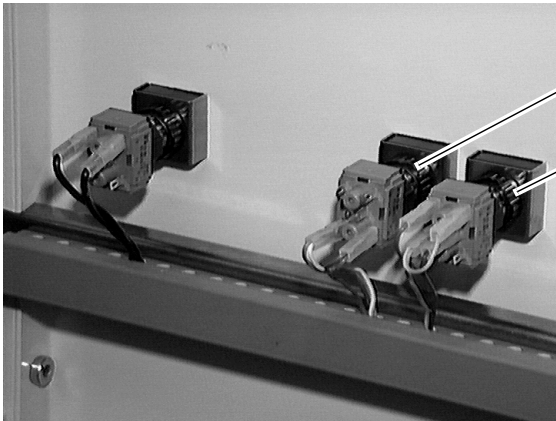
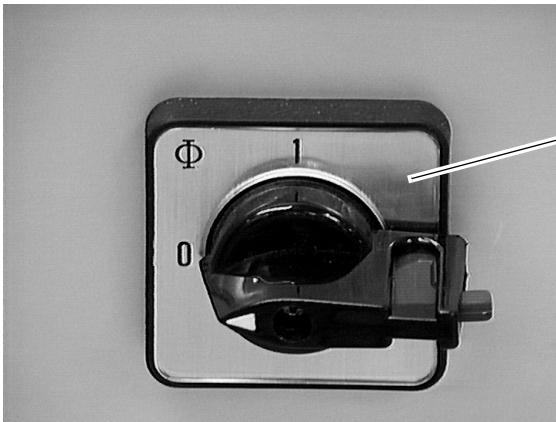
## 12.4.5 Gripper



Pos.	ADIC/ GRAU-No.	Manufac.-No.	Description
42	401000700		Greifer mit Scanner für 3480 Kassetten Gripper with Scanner for 3480 Cartridges
-	401001220		Greifer für OD-Mixed Media Gripper for OD-Mixed Media
-	401001790		Greifer für STK-Laufwerke 10° Gripper for STK-Tape Units 10°
	401004050		Greifer mit Scanner für D2 Kassetten Gripper with Scanner for D2 Cartridges
	123000163		O-ring for gripper D2
	401004920		Parallelgreifer für große Medien Parallel gripper for large media
	401004930		Parallelgreifer für kleine Medien Parallel gripper for small media

12.4.6 Control Unit





Pos.	ADIC/ GRAU-No.	Manufac.-No.	Description
-	E40700001		Steuerschrank Basisausstattung Control cabinet basic equipment
43	15a040001		Einschublüfter SK3142 24VDC (Lüfter für Antriebsverstärker) plug-in ventilator
44	15a200010	3842 403 353	Servo-Rack für 6 Achsen (19" Rack für Antriebsverstärker) servo rack for 6 axis
45	15a007002	3842 403 206	Stromver.-Einschub (Netzteil 160) current supply plug-in package
46	15a200036	3842 403 498	Achskarte SM 6,5/20 GC (Achse 1-4) (Antriebsverstärker) axis board
47	15a200002	3842 404 096	Netzteil 5kVA (Netz-Einschub) power pack
48	15a200006	3842 403 460	PHG hand held programming unit
	15a200028		PHG Folie deutsch foil in German, for PHG
	15a200027		PHG Folie englisch foil in English, for PHG
49	15a020003	276126	Konverter PSM-EG-RS232/RS422-P/4K (Schnittstellen-Modem) converter
50	15q180002	GK20 C51344	Hauptschalter 20A main switch
51	15f010006		Sicherungsautomat 1-polig, 6A Typ:B automatic circuit breaker
52	15v240001	61.997.5	LED grün (in Taster) LED green

Pos.	ADIC/ GRAU-No.	Manufac.-No.	Description
53	15v240003	61.997.4	LED gelb (in Taster) LED yellow
54	15e400001	356-25-33	Netzentstörfilter FN mains suppression filter
55	15a200039		CP-MEM5Prozessorplatte 15 MHz (Karte CP/MEM 5) processor plate
	15a200040		CP-MEM5 Prozessorplatte 30 MHz (Karte CP/MEM 5) für 2 QT ! processor plate for 2 Q-tower !
	15a200030		operating system for rho3 (TO03G)
	15a200042		operating system for rho3 (TO05L)
56	15a200016	1070047181	Netzteil PS75 power pack
57	15a200017	1070071304	Steckkarte PC-I/O+CAN (Karte NC-SPS-I/O) plug-in card
58	15a200018	1070913572	CP/MEM Batterie CP/MEM battery
59	15a200019	1070047961	Eingangs-Karte 24V/32F input adapter
60	15a200020	1070050560	Ausgangs-Karte 24V/0,5A output adapter
61		107066796	Filtermatte RC/filter mat
62		107066797	Filtermatte SPS/filter mat

## Option Quadro tower

Pos.	ADIC/ GRAU-No.	Manufac.-No.	Description
-	E40700004		Steuerschrank Option Quadro tower Control cabinet option Quadro tower



## Spare Parts

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Pos.	ADIC/ GRAU-No.	Manufac.-No.	Description
63	15a200037	3842 403 499	Achskarte SM 6,5 /30 GC EC (Achsen 5 - 6) (Antriebsverstärker) axis card

### Option Hexa tower

Pos.	ADIC/ GRAU-No.	Manufac.-No.	Description
-	E40700007		Steuerschrank Option Hexa tower Control cabinet option Hexa tower
64	15u010001	13 4BA00	Micro-Master MM75 6SE30 (Frequenzumrichter/frequency conver- ter)
-	15k010054	10-0BB4	Schütz 3TF20 contactor
-	15k020001	29 53 85 4	Relais Modul 1W EMG 17-REL/KSR- 24/21 relay module
-	15k020002	29 50 32 3	Relais Modul 2W EMG 22-REL/KSR- 24/21-21 relay module

### 12.4.7 AMU

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Pos.	ADIC/ GRAU-No.	Manufac.-No.	Description
-	E40700002		AMU (AML Management Unit) Ersatz- teile AMU spare parts
-	15a230108		Rechner PS/2 computer
-	15a230014	6450128	Speichererweiterung 4MB expansion unit

<b>Pos.</b>	<b>ADIC/ GRAU-No.</b>	<b>Manufac.-No.</b>	<b>Description</b>
-	15a230012	8515022	Farbbildschirm 14" XGA colour screen
-	15a500002	Nr. 6450350	Maus für IBM PS/2 mouse for IBM
-	15a910001		BOCAMODEM Ultra Performance M144GR
-	15a230002	6451013	Dual ASYNC Adapter

### Option Token Ring

Pos.	ADIC/ GRAU-No.	Manufac.-No.	Description
-	E4070005		AMU (AML Management Unit) Option Token Ring AMU option Token Ring
-	15a230001	92F4520	Token Ring Adapter

### Option Coaxial Card

Pos.	ADIC/ GRAU-No.	Manufac.-No.	Description
-	E40700006		AMU (AML Management Unit) Option Koaxkarte AMU option coaxial card
-	15a230003	39F7597 IBM	Koaxkarte 3270 Connection coaxial card

### Option Ethernet Card

Pos.	ADIC/ GRAU-No.	Manufac.-No.	Description
-	E40700011		AMU (AML Management Unit) Option Ethernetkarte AMU option Ethernetcard
-	15a930001		Etherlink Karte Koax 10BASE-T Etherlink Card coaxial

### Option German Keyboard

Pos.	ADIC/ GRAU-No.	Manufac.-No.	Description
-	E40700008		AMU (AML Management Unit) Option Tastatur deutsch AMU option keyboard German
-	15a230013	1391403	Tastatur deutsch keyboard German

## Option English Keyboard

<b>Pos.</b>	<b>ADIC/ GRAU-No.</b>	<b>Manufac.-No.</b>	<b>Description</b>
-	E40700009		AMU (AML Management Unit) Option Tastatur englisch AMU option keyboard English
-	15a230099	1391406	Tastatur englisch keyboard English

## Option French Keyboard

<b>Pos.</b>	<b>ADIC/ GRAU-No.</b>	<b>Manufac.-No.</b>	<b>Description</b>
-	E40700010		AMU (AML Management Unit) Option Tastatur französisch AMU option keyboard French
-	15a230100	1391402	Tastatur franz. keyboard French

### 12.4.8 Cut-Out and Fine-Wire Fuses

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Pos.	ADIC/ GRAU-No.	Manufac.-No.	Description
-	E40700012		Schmelz- und Feinsicherungen Cut-out fuses and fine-wire fuses
-	15f110003	45G600	Feinsicherung 2 A T (Ausgangs-Karte), fine-wire fuse
-	15f110004	45G264	Feinsicherung 10 A F (Netzteil PS75), fine-wire fuse
-	15f110005	45G55	Feinsicherung 3, 15 AMT (Karte NC-SPS-I/O), fine-wire fuse
-	15f110007	45G615	Feinsicherung 2, 5 A T /415V (Netzteil 160 F1) fine-wire fuse
-	15f110008	46G333	Feinsicherung 10 A T, (Netzteil 160 F2) fine-wire fuse
65	15f260001		Sicherung Neozed 10 A fuse
-	15f110011		Behälter Typ:AB 6-12 box

#### 12.4.9 Storage Boxes for Library Segments

Pos.	ADIC/ GRAU-No.	Manufac.-No.	Description
	323000774		cover for all types of handling boxes
	322000360		handling box for 3480/90 cartridges
	323004757		box for 3480/90 cartridges
	323004756		box for 3480/90 cartridges with teach label
	402003490		handling box for D2 medium cartridges
	402004600		box for D2 medium cartridges
	402004610		box for D2 medium cartridges with teach label
	402003110		handling box for D2 small cartridges
	402004620		box for D2 small cartridges
	402004630		box for D2 small cartridges with teach label
	402002890		handling box for TK cartridges
	402004680		box for TK cartridges
	402004690		box for TK cartridges with teach label
	402001120		handling box for VHS cartridges
	402004700		box for VHS cartridges
	402004710		box for VHS cartridges with teach label
	402002470		handling box for Optical Disc 512
	402004640		box for Optical Disc 512
	402004650		box for optical disc 512 with teach label
	402001180		handling box for optical disc reflection
	402004660		box for optical disc reflection

## Spare Parts

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Pos.	ADIC/ GRAU-No.	Manufac.-No.	Description
	402004670		box for optical disc reflection with teach label
	402003100		handling box for 8 mm cartridges
	402004580		box for 8 mm cartridges
	402004590		box for 8 mm cartridges with teach label
	402003320		handling box for 4 mm cartridges
	402004560		box for 4 mm cartridges
	402004570		box for 4 mm cartridges with teach label

## 12.4.10 Accessories and Tools for Repairs

## Mechanics

Pos.	ADIC/ GRAU-No.	Manufac.-No.	Description
-	402000698		Sicherungswinkel 45 x 45 mit Hammerschraube und Mutter M8 (Feststellen der Achse 3) angle 45 x 45 with hammer head bolt and nut M8 (for ascertaining axis 3)
	171000029		Innensechskan Drehschlüsselsatz Allenkey set

## Quadro tower

Pos.	ADIC/ GRAU-No.	Manufac.-No.	Description
-	170000000		Meßuhr (Zahnflankenspiel des Getrie- bes einstellen) dial gauge (for adjusting the play of tooth profile)
-	170000001		Halterung für Meßuhr fixing device for dial gauge

## Electrical

Pos.	ADIC/ GRAU-No.	Manufac.-No.	Description
-	171000006		Lösewerkzeug H-D 11.1610 loosening tool
-	171000007		Einsatz- und Lösewerkzeug insert and loosening tool
-	171000031		Demontagewerkzeug für Schaltelement 61.9710.0 dismounting tool for circuit element



### 12.4.11 Standard Supply of Accessories

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#### Mechanics

Pos.	ADIC/ GRAU-No.	Manufac.-No.	Description
-	401000304		Teach-Lehre 7° (3490/3590) Teach template
-	401000305		Teach-Lehre 0° (6390/7490) Teach template
-	401000306		Teach-Lehre `80 (3480/3580, Philips LMS) Teach template
-	401001089		Teach-Lehre `80 (6380/7480) Teach template
-	401000638		Teach-Lehre (5180 Tandem) Teach template
-	401000402		Teach-Lehre VHS-Medium Teach template
-	401000403		Teach-Lehre OD Refection Teach template
-	401003270		Teach-Lehre D2 Teach template
-	401003280		Teach-Lehre OD 512 Jukebox IBM 3995,EA Teach template
-	401003290		Teach-Lehre OD 512 Sony Teach template
-	401004550		Teach-Lehre 4mm HP Teach template
-	401000531		Teach Lehre 8mm Teach template
-	401000921		Teach-Lehre DLT Teach template
-	401001604		Teach-Lehre STK 9490 Timberline Teach template
-	401001861		Teach-Lehre DTF Large, Small, Betacam Teach template

<b>Pos.</b>	<b>ADIC/ GRAU-No.</b>	<b>Manufac.-No.</b>	<b>Description</b>
-	401001691		Teach-Lehre SNI3588, STK4890, Mag-star Teach template
	401001802		Teach-Lehre CD-Caddy Teach template

Electrical

<b>Pos.</b>	<b>ADIC/ GRAU-No.</b>	<b>Manufac.-No.</b>	<b>Description</b>
-	327000365		Kabel für Inbetriebnahme cable for operation

### 12.4.12 Accessories and Tools for Maintenance

#### Mechanics

Pos.	ADIC/ GRAU-No.	Manufac.-No.	Description
-	170000005		Spannvorrichtung Zahnriemen VY668 (für Zahnriemen nachspannen x-Achse) tensioned device toothed drive belt VY668 (for regulating the tension of the toothed belt x-axis)
-	170000007		Clavis-Riemenspannmeßgerät (30-300 Hz) (für Riemenspannung mes- sen Achse 1 und 3 und Vorgelege) Clavis belt stretcher measuring instru- ment (30-300 Hz) (for measuring the belt tension and transmission of axis 1 and 3)
-	170000006		Federwaage 10 N (Riemenspannung Achse 2 messen) spring balance 10 N (for measuring belt tension of axis 2)

#### Quadro tower

Pos.	ADIC/ GRAU-No.	Manufac.-No.	Description
-	144000010		Fettpresse (Achtung: nur in Verbindung mit Panzer- schlauch) (Schmieren des Kreuzrollenla- gers und Vierpunktlagers) grease gun (Attention: only in connection with ar- moured tube) (for lubricating of the cross roller bearing and four-point bearing)
-	140000364		Panzerschlauch armoured tube
-	178000001		Fett Retinax EP (Vierpunktlager, Kreuz- rollenlager, jährlich 200 g) grease Retinax EP (four-point bearing, cross roller bearing, 200 g yearly)

Pos.	ADIC/ GRAU-No.	Manufac.-No.	Description
-	134000000		Schmierfett Grafloscon C-SG 0 Ultra (100 g jährlich, für Zahnräder des Quadroturms) grease (for toothed wheels QT, 100 g yearly)
-	173000004		Loctite Rohrgewindedichtmittel 572 (Abdichten jährlich) Loctite pipe thread proofing compound 572 (for sealing, yearly)

## Control cabinet

Pos.	ADIC/ GRAU-No.	Manufac.-No.	Description
-	15a200021		Filtermatte rho (bei Bedarf) filter matting rho (when required)
-	15a200034		Filtermatte SPS (bei Bedarf) filter matting SPS (when required)
-	15a200018		CP/MEM Batterie (jährlich) CP/MEM battery (yearly)

## Handling unit

Pos.	ADIC/ GRAU-No.	Manufac.-No.	Description
-	178000000		Fett Isoflex Topas (Linearführungen) (halbjährlich) grease Isoflex Topas (linear guidance, semi-yearly)
-	173000005		Loctite 243 Schraubensicherungsmittel (für Riemenspannung Achse 3 halbjährlich) Loctite 243 for screw locking (for belt tension axis 3, semi-yearly)

### 12.4.13 AML/2 Literature

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Manual	Language	Order No.
Operator Guide AML/2	German	DOC B00 000
	English	DOC B00 001
Maintenance Guide 2.3 AML/2	German	DOC B00 018
	English	DOC B00 019

### 12.4.14 AML/E Literature

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Manual	Language	Order No.
Operator-Guide AML/E	German	DOC C00 002
	English	DOC C00 003
Maintenance Guide 2.3 AML/E	German	DOC C00 021
	English	DOC C00 022
Installation Guide 2.3 AML/E	German	DOC 000 018
	English	DOC C00 019

### 12.4.15 AML/J Literature

Manual	Language	Order No.
Operator-Guide AML/J	German	DOC D00 002
	English	DOC D00 003
	French	DOC D00 008
Maintenance Guide 2.4 AML/J	German	DOC D00 009
	English	DOC D00 010
Installation Guide AML/J	German	DOC D00 006
	English	DOC D00 007

### AMU Literature

Manual	Language	Order No.
AMU Installation Guide	English	DOC E00 003
AMU Reference Guide	German	DOC E00 004
	English	DOC E00 005
AMU Problem Determination Guide	German	DOC E00 006
	English	DOC E00 007
AML Controller User Guide	English	DOC E00 014

### 12.4.16 HOST Software Literature

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#### HACC/MVS

Manual	Language	Order No.
General Information Manual	German	DOC H00 019
	English	DOC H00 007
Installation and Customization	German	DOC H00 017
	English	DOC H00 005
System Reference Guide	German	DOC H00 016
	English	DOC H00 001
Operator Guide	German	DOC H00 018
	English	DOC H00 003
Messages and Codes	German	DOC H00 020
	English	DOC H00 009
Operator Quick Reference	German	DOC H00 026
	English	DOC H00 015
ISPF User Guide	German	DOC H00 021
	English	DOC H00 011
Conversion Notebooke	German	DOC H00 024
	English	DOC H00 025
Installation and Customization Reference	German	DOC H00 023
Command Reference	German	DOC H00 022

**HACC/VM**

Manual	Language	Order No.
System Reference Guide	German	DOC V00 009
	English	DOC V00 001
Installation and Customization	German	DOC V00 008
	English	DOC V00 005
Operator Guide	German	DOC V00 006
	English	DOC V00 007

**HACC/OS 400**

Manual	Language	Order No.
User Guide	English	DOC O00 001
Backup/Restore User Guide	English	DOC O00 001

**HACC/DAS**

Manual	Language	Order No.
Administration Guide	English	DOC F00 010
Interfacing Guide	English	DOC F00 011
Interfacing Guide Win-NT/95	English	DOC F00 015
Message Filter Installation Guide	English	DOC F00 012
VirOp for IMS User Guide	English	DOC F00 013

**VolServ**

Manual	Language	Order No.
VolServ 2.3 Documentation		



## Spare Parts

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Manual	Language	Order No.
Set for SGI	English	600308-01
Set for Solaris	English	600308-02
Set for Sun	English	600308-03
VolServ 2.2 Documentation		
Set for Convex	English	600254-01

## AMASS

Manual	Language	Order No.
AMASS 4.5 Documentation		
Set	English	600307
AMASS 4.7 Documentation		
Set	English	600614



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